A., I.—General, Physical, and Inorganic Chemistry

JANUARY, 1939.

Fine structures of H_a and D_a under varying discharge conditions. R. C. WILLIAMS (Physical Rev., 1938, [ii], **54**, 558—567).—The fine structures were observed under varying conditions of excitation in a discharge tube with pure H_2 and pure D_2 at liquid air temp. The positions of fine structure components were invariant with changing discharge conditions. Analyses of intensities were made. The average separation of the two main components was 0·319 cm.$^{-1}$ for H_a and 0·321 cm.$^{-1}$ for D_a. The second and third most intense components were resolved in D_a but not in H_a; the average interval was 0·130 cm.$^{-1}$ The respective theoretical intervals are 0·328 and 0·108 cm.$^{-1}$ N. M. B.

Effect of positive-ray collisions on the polarisation of spectral lines in the magnetic field. J. STARK and H. VERLEGER (Physikal. Z., 1938, **39**, 763—767).—The intensity of spectral lines of H, He, and C^+ when collisions occur between the radiating gas and positive rays in a magnetic field has been determined when the direction of the positive rays is perpendicular or parallel to the magnetic field. The intensity in directions parallel (I_p) and perpendicular (I_s) to the magnetic field was determined. For collisions perpendicular to the magnetic field, $I_p/I_s < 1$, whilst for collisions parallel to the field, $I_p/I_s > 1$. I_p/I_s was also determined for H_a, H_β, and H_γ for fields of 0—20,000 gauss. The deviation of I_p/I_s from unity decreases with decreasing pressure. A. J. M.

Series spectrum of helium. I. W. VON MEYEREN (Z. Physik, 1938, **111**, 46—54).—Light from He at 1·5 × 10^{-1} mm., excited by the impact of fast electrons (up to 1800 e.v.), is photographed in the short-wave visible and the ultra-violet ranges, and the intensity distribution within the series is discussed. Seven new members of the secondary singlet series 2^1P-n^1D are found. L. G. G.

Connexion between strengthening and weakening of series by the electric field. R. RITSCHL and R. SIKSNA (Physikal. Z., 1938, **39**, 767—772).—The variation of intensity of two strong pairs of lines of ortho-He ($2s$—$4p$, $2p$—$4p$, $2s$—$5p$, $2p$—$5p$) and the line $2S$—$4P$ of para-He in an electric field has been investigated. In addition to the increase of intensity of new transitions caused by the application of the field, there is simultaneous weakening of the lines present without a field, as the field strength is increased. For the $2p$—$4p$ and $2p$—$5p$ lines there are max. intensities for fields of 170 and 150 kv. per cm., respectively. A. J. M.

Negative bands of ^{14}N—^{15}N. R. W. WOOD and G. H. DIEKE (J. Chem. Physics, 1938, **6**, 734—739).—

The negative bands of N_2 containing about 15% of ^{15}N have been photographed, and the 0 → 0, 1 → 0, and 0 → 1 bands of the ^{14}N—^{15}N mol. analysed. These bands are situated in agreement with the predictions of the elementary theory of isotopic shifts. They show no intensity alternations and perturbations at the positions in which these occur in the corresponding bands of the ^{14}N—^{14}N mol. W. R. A.

Zeeman effect in the spectrum of neon. J. B. GREEN and J. A. PEOPLES, jun. (Physical Rev., 1938, [ii], **54**, 602—605).—Data for λλ, classifications, J vals., patterns, and g vals. for about 250 lines of Ne in fields of 27,000—32,000 gauss are tabulated. A high-frequency electrodeless discharge was employed, and the λλ range was 3100—9000 A. A no. of "forbidden" lines appear. Calc. and experimental g vals. show close agreement. N. M. B.

Structure of the configurations of high azimuthal quantum number in Cu II and the rare gases. G. H. SHORTLEY and B. FRIED (Physical Rev., 1938, [ii], **54**, 749—753; cf. A., 1933, 1226).—Mathematical. An analysis of data due to Shenstone (cf. A., 1936, 537). N. M. B.

Interferometric wave-length comparison of the red cadmium radiation emitted by different sources. W. E. WILLIAMS and D. V. GOGATE (Proc. Roy. Soc., 1938, A, **167**, 509—516).—A comparison is made of the line λ 6438 A. emitted by a G.E.C. Osira Cd lamp and a Schuler hollow-cathode discharge. The greatest difference recorded was <1 part in 10^8. G. D. P.

Nuclear spin of iodine. III. Further measurements on the fine structures in the first spark spectrum. S. TOLANSKY and G. O. FORESTER (Proc. Roy. Soc., 1938, A, **168**, 78—103; cf. A., 1936, 262).—Earlier measurements are extended into the ultra-violet. The fine structure of 58 lines is known and 39 are allocated to terms which go to the (^4S) or (^2D) series limit. G. D. P.

Radiation from the high-pressure discharge in mercury vapour in different spectral regions. J. KERN (Z. tech. Physik, 1938, **19**, 249—254).—The light efficiency and radiation efficiency in the medium and long-wave ultra-violet regions of the radiation from a high-pressure Hg discharge were determined under various conditions. The ultra-violet efficiency depends only slightly on pressure. A. J. M.

Absorption spectrum of thorium. T. L. DE BRUIN and J. N. LIER (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 956—964).—Intensities and λλ for about 450 lines in the range 5049—2187 A., obtained

by the methods of the under-water spark and the exploding wire, are tabulated.   N. M. B.

Excitation of absorption lines in outer atmospheric shells of stars. O. STRUVE and K. WURM (Astrophys. J., 1938, **88**, 84—109).—The anomalous intensities of He I in the outer shells of certain B stars have been investigated. Physical conditions in the outer shells are discussed.   L. S. T.

Multiplet calibration of the Arcturus spectrum. S. G. HACKER (Astrophys. J., 1938, **88**, 65—83).— The effective photospheric temp. is found to be $3925° \pm 75°$ K., using $5740°$ K. for that of the sun, the mean electron pressure in the star's atm., 3.9×10^{-8} atm., and the level of ionisation, 7·7 v. The relative abundances of the elements present in the star are tabulated.   L. S. T.

Spark potential curves of inert gases at low pressures. H. KLEMPERER (Z. tech. Physik, 1938, **19**, 270).—Spark potential curves for technically pure inert gases are given, and other data relative to the discharge in these gases are collected.   A. J. M.

Quantum-mechanical calculation of the effect of pressure on spectral lines. I. C. REINSBERG (Z. Physik, 1938, **111**, 95—108).—The general theory of broadening and displacement due to pressure is developed as an expansion of the Lorentz theory of impact damping and Margenau's theory of energy distribution at impact.   L. G. G.

Position numbers of electron terms in a partly ionised gas. K. H. RIEWE and R. ROMPE (Z. Physik, 1938, **111**, 79—94).—Term position nos. of Hg and H are calc. and it is shown that neglect of the degree of ionisation can lead to errors in many problems connected with discharge in gases.   H. C. G.

Theory of complex spectra. G. H. SHORTLEY and B. FRIED (Physical Rev., 1938, [ii], **54**, 739—748).—Mathematical. An extension and simplification of existing theory.   N. M. B.

Scattering and photo-electric absorption of high-voltage X-rays in nitrogen. H. C. TRUE-BLOOD and D. H. LONGBRIDGE (Physical Rev., 1938, [ii], **54**, 545—554).—An expansion-chamber investigation of 100—800 ke.v. X-radiation passing through N_2, and a determination of the energy of recoil electrons as a function of the angle of emission, and the angular distribution of photo-electrons as a function of energy, is described. Results are in agreement with the Klein–Nishina formula when allowance is made for the presence of photo-electrons distinguished from recoils by the criterion of max. Compton energy. A preliminary val. of the ratio of recoil electrons to photo-electrons is obtained.   N. M. B.

Secondary emission from clean tungsten. E. COOMES (Physical Rev., 1937, [ii], **51**, 1008).—This emission has been investigated over an energy range for primary electrons of 50—2000 v. Secondary emission is increased when Th is evaporated on to the clean W.   L. S. T.

Optical properties and photo-electric emission in thin films of alkali metals. H. E. IVES and H. B. BRIGGS (J. Opt. Soc. Amer., 1938, **28**, 330—

338).—The photo-electric emission from thin films ($<10^{-8}$ cm.) of K, Rb, and Cs on a Pt–Ir base has been determined. The experimental cell included a device for local cooling to prevent conducting films on the glass. The results support the authors' theory (cf. A., 1937, 1, 285) that the emission $\propto$ the rate of absorption of energy in the topmost layer of the alkali-metal film. The theory is further developed and gives close agreement with experiment.   J. A. K.

Products of dissociation of benzene vapour by electron impact. P. KUSCH, J. T. TATE, and A. HUSTRULID (Physical Rev., 1937, [ii], **51**, 1007).—At an electron energy of 75 v. the ions that have been identified in the mass-spectrograph, and their intensities relative to $C_6H_6^+$, are $C_6H_6^+$, 100; $C_6H_5^+$, 17; $C_6H_4^+$, 5; $C_6H_3^+$, 2; $C_6H_2^+$, 4; C_6H^+, 1·3; C_6^+, 0·25; $C_5H_3^+$, 2·5; $C_5H_2^+$, 0·6; C_5H^+, 0·5; C_5^+, 0·02; $C_4H_4^+$, 13; $C_4H_3^+$, 15; $C_4H_2^+$, 12; C_4H^+, 2; C_4^+, 0·3; $C_3H_3^+$, 6·7; $C_3H_2^+$, 3; C_3H^+, 2·5; C_3^+, 0·3; $C_2H_3^+$, 1·4; $C_2H_2^+$, 1·2; C_2H^+, 0·15; C_2^+, 0·03; CH_3^+, 0·2; CH_2^+, 0·02; CH^+, 0·03; C^+, 0·05; H_2^+; H^+; $C_6H_6^{++}$, 3·3; $C_6H_5^{++}$, 0·4; $C_6H_4^{++}$; $C_6H_3^{++}$, 0·9; $C_6H_2^{++}$; C_6H^{++}, 0·01. Appearance potentials of some of the ions have been obtained.   L. S. T.

Scattering of fast electrons. W. A. FOWLER (Physical Rev., 1938, [ii], **54**, 773).—A comparison of electron scattering data (cf. A., 1938, I, 546) with unpublished computations of Williams on plural and multiple scattering.   N. M. B.

Internal tension and dynamics of the radiating electron. T. DE DONDER and J. GÉHÉNIAU (Compt. rend., 1938, **207**, 719—722).—A mathematical derivation of Dirac's equations (A., 1938, I, 551) is given.   A. J. E. W.

Helium–deuteron and deuteron–deuteron nuclear reactions. M. L. OLIPHANT (Physical Rev., 1938, [ii], **54**, 772).—A correction of Ruhlig (cf. A., 1938, 1, 547) and of Myers (cf. *ibid.*, 551).   N. M. B.

Application of Clay's new value of the Jaffé–Zanstra coefficient for air to high-pressure ion current measurements. J. W. BROXON and G. T. MERIDETH (Physical Rev., 1938, [ii], **54**, 605—608).— Data previously reported (cf. A., 1938, I, 426) are analysed with the help of Clay's new coeff. val. $1·24 \times 10^{-5}$ for air. Revised curves are given and discussed.   N. M. B.

Initial recombination of ions. L. ONSAGER (Physical Rev., 1938, [ii], **54**, 554—557).—Mathematical. The probability of recombination of a pair of ions of given initial separation is computed from the laws of Brownian motion.   N. M. B.

Formation of negative ions at metal surfaces. R. A. SMITH (Proc. Roy. Soc., 1938, **A, 168**, 19—42).— A theoretical discussion of the conditions under which ions are formed at a metal surface. Detailed calculations are given for the conversion of Hg^+ into Hg^- at a Ni surface. W is stated to behave similarly. The process accounts for the observations of other workers. The formation of at. negative ions from mol. positive ions is considered.   G. D. P.

New process of negative-ion formation. IV. F. L. ARNOT and C. BECKET (Proc. Roy. Soc., 1938, **A,**

168, 103—122; cf. A., 1937, I, 274).—The process consists of the capture of one electron by a positive ion at a metal surface; the excited atom may then capture a second electron, so forming a negative ion of the same element as the incident positive ion, or the excited atom may transfer its energy to an adsorbed atom which then captures an electron from the metal surface forming a negative ion of an element different from the incident positive ion. The results of previous work are reviewed in the light of the second of the above processes. G. D. P.

Effective cross-section of positive alkali ions with respect to gas molecules. K. H. BRACE-WELL (Physical Rev., 1938, [ii], **54,** 639—643).—A mass-spectrographic investigation of the absorption of 40—400-v. Na^+ ions in H_2, N_2, and O_2 is described, and curves showing the absorption with reference to neutralisation, retardation, or small angle scattering are given. Mean free paths and effective cross-sections are a function of gas pressure, ion velocity, and the nature of the gas-ion combination. Mean free paths decrease in the order H_2, N_2, O_2, and cross-sections in the reverse order, apparently approaching kinetic theory vals. at zero accelerating potential. N. M. B.

Positive rays and their application in mass spectrography. L. CARTAN (Ann. Physique, 1938, [xi], **10,** 426—502).—The optics of positive rays have been systematically investigated with a view of perfecting the technique of the mass spectrograph. With a newly designed spectrograph, which is described, the isotope ^{12}C has been obtained pure. W. R. A.

Some chemical properties of element 43. II. C. PERRIER and E. SEGRÈ (Atti R. Accad. Lincei, 1938, [vi], **27,** 579—581; cf. A., 1937, I, 545).—Further methods of isolating the active element obtained by bombarding Mo with deuterons in a cyclotron are described, especially its separation from Re. The activity is due to isotopes of element 43. Some chemical properties of this element are described. O. J. W.

Nuclear isomerism in element 43. E. SEGRÈ and G. T. SEABORG (Physical Rev., 1938, [ii], **54,** 772). —Radioactive Mo of half-life 65 hr. (cf. Sagane, A., 1938, I, 594) decays into a 6-hr. activity (ascribed to element 43) which emits a line spectrum of electrons and also X- and γ-radiation. Identifications and explanations are discussed. N. M. B.

Isotopic constitution of mercury and lead. A. O. NIER (Physical Rev., 1937, [ii], **51,** 1007).—A new magnetic mass-spectrograph allows the search for rare isotopes to be extended beyond the limits attainable previously. Hg consists of the isotopes 204, 202, 201, 200, 199, 198, and 196 present in abundances $\propto$ 22·7, 100, 44·6, 78·7, 57·6, 34·2, and 0·50, respectively. Upper limits are set for other possible isotopes. A sample of ordinary Pb consisted of the isotopes 208, 207, 206, and 204 (cf. A., 1938, I, 426). L. S. T.

Isotopes of uranium and lead. A. C. LANE (Science, 1938, **88,** 240).—Historical. L. S. T.

Stopping of the recoil electrons produced by the fluorine + proton γ-rays. J. J. TURIN and H. R. CRANE (Physical Rev., 1937, [ii], **51,** 1012).— The recoil electrons produced by the 6-Me.v. γ-radiation from F bombarded with protons have been passed through absorbers of C and Pb and the losses measured. In C, the losses agree with the theoretical losses due to electron collisions, but in Pb, radiative losses play a large part, and increase with an increase in energy of the incident particle. L. S. T.

Production of high-energy α-particles by the Princeton cyclotron. M. G. WHITE, M. C. HEN-DERSON, W. J. HENDERSON, and L. N. RIDENOUR (Physical Rev., 1937, [ii], **51,** 1012—1013).—Doubly-charged He ions have been accelerated in a cyclotron to 9 Mv. at a current of 0·05 μa. The He beam can be separated almost completely from possible deuteron contamination. L. S. T.

Retardation of neutrons in hydrogen-containing substances. S. FLÜGGE (Z. Physik, 1938, **111,** 109—124).—An extension of the diffusion theory of thermic neutrons is described for calculating the distribution of resonance neutrons in a sphere of paraffin. The Fermi $1/v^2$ law is shown to hold for all points within the sphere. Calc. and experimental vals. of certain consts. are compared. L. G. G.

Disintegrations and production of neutrons by bombardment of Be and of B with α-particles from Po. G. BERNARDINI (Nuovo Cim., 1938, **15,** 220—225).—Range-distribution curves for the emission of neutrons from Po + Be and Po + B have been obtained. The group of neutrons from Be of 2·7 Mc.v. is due to an excited $^{12}_{6}C$ level. The energies of other groups of neutrons emitted are 4·4, 6·5, and 8 Me.v. With B two groups of neutrons of 3·2 and 4·3 Me.v. have been studied. The latter are probably due to $^{11}_{5}B$. O. J. W.

Photographic effects produced by cadmium and other elements under neutron bombardment. J. G. HOFFMAN and R. F. BACHER (Physical Rev., 1938, [ii], **54,** 644—645).—Investigations show that the blackening of X-ray film in contact with Cd exposed to a neutron source is due to slow neutrons and not to γ-rays. If foils of C, Al, Ni, Mo, Sn, W, and Pb are substituted for Cd in thicknesses containing the same no. of atoms per sq. cm. the blackening is much less intense but increases with at. no. Possible mechanisms are discussed. N. M. B.

Production of collimated beams of mono-chromatic neutrons in the temperature range 300—10° K. L. W. ALVAREZ (Physical Rev., 1938, [ii], **54,** 609—617).—An electrical velocity selector for the production and use of highly collimated beams of pure thermal neutrons, variable as to mean temp. over a wide temp. range, is described. Fast neutron effects are entirely eliminated. Qual. verification of the $1/v$ law for B has been extended to 30° K. N. M. B.

Neutron groups. Y. SUGIURA and O. MINA-KAWA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34,** 1299—1307).—The activity of $D + D$ neutrons has been measured by means of detectors placed at a fixed distance from the neutron source,

with paraffin plates of various thicknesses interposed between the source and the detector. The detectors used were Ag (22 sec.), Rh (44 sec. and 4·2 min.), In (54 min.), and I (25 min.). Comparison of the curves of activity against thickness of paraffin plate for the various detectors indicates approx. the order of the lowest resonance energies of different neutron groups as Rh (44 sec.) > In > Ag > I > Rh (4·2 min.). — W. R. A.

Scattering of slow neutrons by paramagnetic salts. M. D. WHITAKER, H. G. BEYER, and J. R. DUNNING (Physical Rev., 1938, [ii], 54, 771; cf. A., 1937, I, 544).—Measurements of the effective cross-section of $MnSO_4$, MnS, MnO, and Fe_2O_3 compared with the additive cross-sections of the constituent elements are tabulated. Results show an increase in scattering of the salts over the additive cross-sections. Measurements of the angular distribution of the scattered neutrons are discussed. N. M. B.

Resonance absorption of slow neutrons. A. E. DOWNING and C. D. ELLIS (Nature, 1938, 142, 793).— The positions of resonance levels of certain elements for slow neutrons have been measured by a paraffin absorption method. Bi has levels at ~1 v. and ~11 v., representing high excited states of Ra-E, Th near 2 and 18 v., U at ~5 and ~30 v., and Co at ~1 v. Two resonance levels indicated for I explain the anomalous results obtained recently by Michiels (A., 1938, I, 547). L. S. T.

Neutron–proton ratio of natural radioactive elements and relationships in the disintegration series. W. MINDER (Helv. Phys. Acta, 1938, 11, 497—506).—A plot of the neutron–proton ratio (R) against Z shows that the three known disintegration series are entirely analogous between $Z = 82$ and 90. A gap between the U and Th series suggests the existence of a fourth disintegration series involving the known α-emission reaction of Ac. A no. of hypothetical reactions giving rise to such a series, and providing links between the known series, are discussed. Relationships between R and nuclear stability are also discussed. A. J. E. W.

Capture of protons by oxygen. L. A. DuBRIDGE, S. W. BARNES, and J. H. BUCK (Physical Rev., 1937, [ii], 51, 1012).—The capture of protons of various energies by O_2 to yield radio-F has been investigated by means of the cyclotron. The reaction commences at a proton energy of ~1·4 Me.v., rising sharply as far as 2·5 Me.v. The preliminary val. obtained for the period of radio-F is 81 sec., which is > that reported for the radio-F produced in other reactions. The presence also of a much longer period is indicated. L. S. T.

Transmutation of argon and chlorine by α-particles. E. POLLARD, H. L. SCHULTZ, and G. BRUBAKER (Physical Rev., 1937, [ii], 51, 1014).— When bombarded by α-particles from Ra-C or Th-C', A and Cl emit neutrons; the yield from A is > that from Al, whilst that from Cl is approx. one quarter as great. Suggested reactions are $^{40}A + ^4He = ^{43}Ca + ^1n$ and $^{37}Cl + ^4He = ^{40}K + ^1n$. Vals. for the nuclear radii are discussed. L. S. T.

K-Electron capture in ^7Be. G. BREIT and J. K. KNIPP (Physical Rev., 1938, [ii], 54, 652—656).—A discussion of various data and related theory. N. M. B.

Nuclear transmutations of the lithium isotopes. L. H. RUMBAUGH, R. B. ROBERTS, and L. R. HAFSTAD (Physical Rev., 1938, [ii], 54, 657—680; cf. A., 1937, I, 5, 438; 1938, I, 427).—Yield curves were obtained for 8 main transmutation processes of ^6Li and ^7Li produced by proton and deuteron bombardment. Relative and approx. abs. yields are computed. The formation and decay processes of ^8Li were investigated; the mass is 8·02499±0·00020. The range-distribution of the delayed α-particles from ^8Li was measured and its interpretation is discussed. The observed reaction energy of $^6Li + n \rightarrow ^4He + ^3H$ is 4·97 compared with 4·56 Me.v. derived from the masses involved. There was no evidence of $^7Li + n \rightarrow ^8Li$. The process $^6Li + ^2D \rightarrow ^7Be + n$ was indicated by measurements of energies of the neutrons produced. ^7Be is radioactive and is converted into ^7Li by K-electron capture followed by γ-ray emission in ~10% of the transitions. N. M. B.

Radioactivity induced by α-particles. L. N. RIDENOUR, W. J. HENDERSON, M. C. HENDERSON, and M. G. WHITE (Physical Rev., 1937, [ii], 51, 1013).— The radioactivity produced by the bombardment of light elements with 0·05 μamp. of 9-Me.v. α-particles produced by a cyclotron has been investigated. The accepted val. of 3·3 min. for the half-life of ^{30}P is probably incorrect; the val. now obtained is 2·52±0·05 min. Half-life periods for the radio-elements produced from B, N, and Al are 10·5 min. (^{13}N), 69 sec. (^{17}F), and 2·52 min. (^{30}P), respectively. L. S. T.

Energy levels of the ^{24}Mg nucleus. A. SUGIMOTO (Nature, 1938, 142, 754—755).—An energy level scheme for ^{24}Mg which accounts for the energy and relative intensities of the β- and γ-radiations emitted by ^{24}Na is outlined. L. S. T.

Decay constant of ^{32}P. N. B. CACCIAPUOTI (Nuovo Cim., 1938, 15, 213—219).—The half-life period of ^{32}P obtained by the bombardment of P with deuterons is 14·295 days. O. J. W.

Nuclear transformations produced in zinc by α-particle bombardment. W. B. MANN (Physical Rev., 1938, [ii], 54, 649—652).—Zn bombarded with 17-Me.v. α-particles gives rise to activities : ^{70}Ga 19·8±0·4 min., Ge 37±1·5 hr., ^{67}Ga 79±2 hr., and Ge ~195 days. The disintegration products are mainly positrons. N. M. B.

Resonance transmutation of Se (34) by protons. J. H. BUCK, C. V. STRAIN, and G. VALLEY (Physical Rev., 1937, [ii], 51, 1012).—The excitation function for induced radioactivity of Se has been determined over the range 1·7 to 3·6 Me.v. Measurable activity begins at 2·3 Me.v. and increases sharply at ~ 3·1 Me.v. L. S. T.

Transmutation of aluminium by polonium α-particles. W. R. KANNE (Physical Rev., 1937, [ii], 51, 1013).—A redetermination of the absorption curve of the protons emitted from an Al target confirms the results of Chadwick and Constable (A., 1932,

318). The energy of the γ-ray from the final $^{30}_{14}Si$ nucleus is 2·5 Me.v., and the ratio of the intensities of the short and long-range groups is 3·5. L. S. T.

Deuteron bombardment of barium, lanthanum, and cerium. M. L. POOL and J. M. CORK (Physical Rev., 1937, [ii], 51, 1010).—On bombardment with 6·5-Mv. deutrons Ba becomes strongly radioactive with a half-life period of 85·6 min. The β-particles have the negative sign, and chemical analysis shows that the activity is probably due to ^{139}Ba. ^{139}La gives a radioactivity with a half-life period of 31 hr. The β-particles are negative, and the activity is attributed to ^{140}La. Ce gives a 2·4 hr. period.
L. S. T.

Radioactivity in iron by deuteron bombardment. B. T. DARLING, B. R. CURTIS, and J. M. CORK (Physical Rev., 1937, [ii], 51, 1010—1011).—After bombardment of electrolytic Fe by 6·3-Me.v. deuterons, chemical separations show that the Co ppt. has a strong positive activity of 18·2 hr. half-life, corresponding with the capture of a proton with the probable ejection of a neutron. The Mn ppt. shows an activity of 21 min. half-life, indicating the capture of the deuteron with the ejection of an α-particle. No activity of half-life long enough to be observed after the chemical separation could be found in the Fe itself due to neutron capture. L. S. T.

Production of radium isotopes from uranium by irradiation with rapid and slow neutrons. O. HAHN and F. STRASSMANN (Naturwiss., 1938, 26, 755—756).—The nature of the product of half-life period 3·5 hr. obtained by Curie et al. (A., 1938, I, 291) by irradiation of U by neutrons is discussed. It is regarded as a mixture of products already isolated. Irradiation of U by neutrons gives rise to three isomeric Ra isotopes, which must be produced by two successive α-ray transformations through Th. The half-life periods are approx. 25 min., 110 min., and several days. These Ra isotopes give rise to three isomeric Ac isotopes with emission of β-rays, of half-life periods approx. 40 min., 4 hr., and 60 hr. Three Th isotopes are formed from the Ac isotopes. The production of Ra from U is the first case of α-transformations brought about by the use of retarded neutrons. Irradiation of ^{238}U with neutrons gives rise to 16 different artificially radioactive nuclei of at. nos. 88—90 and 92—96. A. J. M.

Counting losses in Geiger-Müller counter circuits and recorders. H. LIFSCHUTZ and O. S. DUFFENDACK (Physical Rev., 1938, [ii], 54, 714—725).—Detailed experimental investigations are described, and results are considered in relation to various theoretical equations. N. M. B.

Cosmic-ray showers from lead plates. R. B. BRODE and M. A. STARR (Physical Rev., 1937, [ii], 51, 1006).—Results obtained from 8000 photographs of showers produced in Pb plates of thickness 1·5—16·5 mm. placed in a Wilson cloud chamber are summarised. L. S. T.

Cosmic-ray showers produced under 30 m. of clay. J. D. CRAWSHAW (Proc. Physical Soc., 1938, 50, 783—787).—The approx. equality of the ratio of the vertical intensity to the max. shower rate at ground level and under 30 m. of clay is confirmed (cf. Follett, A., 1936, 1174). A transition curve for showers from Pb at the lower level is discussed.
N. M. B.

Relation of shower frequency to general cosmic-ray intensity. L. JÁNOSSY (Proc. Roy. Soc., 1938, A, 167, 499—508).—Observations were carried out at sea level and under 30 m. of clay to ascertain how the form of the shower transition curves at the two levels depends on the presence of large masses of light material (stone) over the Pb absorber producing the showers. It is concluded that most of the showers at sea level and underground are due to secondaries produced by the penetrating particles, and that relatively few can be due to primary electrons. G. D. P.

Quantum theory and origin of some swarms of cosmic rays. G. WATAGHIN (Atti R. Accad. Lincei, 1938, [vi], 27, 675—678).—Mathematical.
O. J. W.

Cosmic-ray showers and bursts. D. K. FROMAN and J. C. STEARNS (Rev. Mod. Physics, 1938, 10, 133—192).—A comprehensive report of available experimental and theoretical data with detailed bibliography. N. M. B.

Theory of energy losses of high-energy particles. L. W. NORDHEIM (J. Franklin Inst., 1938, 226, 575—597; cf. A., 1938, I, 550).—The absorption of cosmic radiation and the majority of its secondary effects can be explained by electromagnetic theory if the soft component is identified with electrons and protons, and the hard component with barytrons. An extension of the theory of Yukawa (Proc. Phys. Math. Soc. Japan, 1938, 20, I and loc. cit.) may provide the explanation of the remaining phenomena (the production of hard rays in the atm., hard showers, and some bursts). O. D. S.

Primary and secondary cosmic rays, showers, and bursts. W. M. NEILSEN. Survey of evidence for the nature of the hard component. J. C. STEARNS. Copper shows an anomalously high efficiency for the production of showers when compared with zinc. D. K. FROMAN (J. Franklin Inst., 1938, 226, 601—622, 628, 629—630).—Nos. of triple and quadruple coincidences under varying thicknesses of Pb have been compared at altitudes 36 m. and 4300 m. Results are in qual. agreement with the multiplicative theory of shower production. The ratio of triple to quadruple coincidences is greater at the greater altitude. O. D. S.

Production of showers by cosmic rays. C. G. MONTGOMERY and D. D. MONTGOMERY (J. Franklin Inst., 1938, 226, 623—627).—When the "background" is very small the shower-producing capacity of an atom will be approx. $\propto Z^4$. This prediction is supported by preliminary experiments in the open air. Some showers of an explosive type have been observed, apparently formed in the air. A comparison has been made between the no. of showers due to electrons and protons and the no. due to the whole cosmic radiation in varying thicknesses of Pb. At thicknesses > 10 cm. Pb the no. produced by electrons is ≪ that produced by the whole radiation.
O. D. S.

Effect of galactic rotation on the intensity of cosmic radiation. W. F. G. SWANN (Physical Rev., 1937, [ii], **51**, 1006).   L. S. T.

Orbital electronic network of several elements. R. FORRER (Ann. Physique, 1938, [xi], **10**, 407—425; cf. A., 1937, I, 231).—Using the law $T = F\sqrt{N}$ (A., 1935, 1305), the electronic networks of the alkali and alkaline-earth metals, Se, Te, P, and I have been determined.   W. R. A.

Photo-electric absorption of radiation in gases. R. W. DITCHBURN (Nature, 1938, **142**, 756).—A discussion (cf. A., 1938, I, 543).   L. S. T.

Wave functions for $1s2s\,^3S$ Li^+. H. M. JAMES and F. L. YOST (Physical Rev., 1938, [ii], **54**, 646—647; cf. A., 1937, I, 391).—The comparative results of alternative methods of determining at. wave functions are examined.   N. M. B.

Test of the wave mechanics in molecular spectra and some recent developments in the spectrum of H_2. O. W. RICHARDSON (Nuovo Cim., 1938, **15**, 232—245).—A brief account of recent improvements in the experimental and theoretical determinations of some of the fundamental consts. connected with the electronic states of H_2 and of H_2^+. Two new states of H_2 have been found in which apparently both electrons are excited.   O. J. W.

Wave functions and potential curves for excited H_2. A. S. COOLIDGE and H. M. JAMES (J. Chem. Physics, 1938, **6**, 730—734).—Mathematical.   W. R. A.

Binding energy of ^6Li. H. MARGENAU and K. G. CARROLL (Physical Rev., 1938, [ii], **54**, 705—713).—Mathematical.   N. M. B.

α-Particle model of the nucleus. L. R. HAFSTAD and E. TELLER (Physical Rev., 1938, [ii], **54**, 681—692).—The theory of nuclei composed of α-particles alone is reviewed and extended to cases where, in addition, a single neutron or proton is present, and to light nuclei in which a single neutron or proton is missing. Configurations are considered and rough vals. for the binding energies are compared with the results of the Hartree model. Rotations of the nuclei and symmetry properties and spacing of some of the excited states are examined.   N. M. B.

Magnetic moments of heavy nuclei. T. NEUGEBAUER (Z. Physik, 1938, **111**, 125—132).—Theoretical.   H. C. G.

Determination of e/m from the H_a–D_a interval. R. C. WILLIAMS (Physical Rev., 1938, [ii], **54**, 568—572).—Calculations based on the corr. interval $4{\cdot}14700\pm0{\cdot}0004$ cm.$^{-1}$ between the $2p^2P_{3/2}$–$3d^2D_{5/2}$ components of H_a and D_a, the new val. $9651{\cdot}3$ for the physical Faraday adjusted to the at. mass scale, and the most recent at. wt. vals. of H and D lead to the val. $1{\cdot}7579\pm0{\cdot}0004 \times 10^7$ for e/m.   N. M. B.

Most probable values of e, e/m, and h. III. K. SHIBA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1308—1321; cf. A., 1933, 884).—From the available data the following most probable vals. are deduced : $e = (4{\cdot}8025\pm0{\cdot}02\%) \times 10^{-10}$ e.s.u.; $e/m =$ $1{\cdot}7589\pm0{\cdot}02\%) \times 10^7$ e.m.u.; $h = (6{\cdot}625\pm0{\cdot}04\%)$ $\times 10^{27}$ erg sec.; $hc/2\pi e^2 = 137{\cdot}04\pm0{\cdot}02\%$.   W. R. A.

Determination of e/m from the refraction of X-rays in a diamond prism. J. A. BEARDEN (Physical Rev., 1938, [ii], **54**, 698—704).—Measurements accurate to 1 part in 10^4 for n of the Cu $K\beta$ line by a diamond prism, together with the quantum theory of dispersion and the ruled grating λ of the Cu $K\beta$ line, lead to a val. $e/m = (1{\cdot}7610\pm0{\cdot}0003) \times 10^7$ e.m.u., in good agreement with the free electron results of Dunnington (cf. A., 1937, I, 595).   N. M. B.

Maximum energy of the protons emitted by boron under α-particle bombardment. G. BRUBAKER and E. POLLARD (Physical Rev., 1937, [ii], **51**, 1013).   L. S. T.

Coulomb wave functions for high energies. L. E. HOISINGTON and G. BREIT (Physical Rev., 1938, [ii], **54**, 627—628).—Mathematical.   N. B. M.

Influence of radiation on ionisation equilibrium. B. N. SRIVASTAVA (Proc. Roy. Soc., 1938, A, **167**, 484—499).—A theoretical investigation of the equilibrium of an assembly of atoms, ions, electrons, and radiation, the particles being supposed to obey any statistics.   G. D. P.

Physical processes in gaseous nebulæ. III. The Balmer decrement. J. G. BAKER and D. H. MENZEL (Astrophys. J., 1938, **88**, 52—64).—A numerical solution of the equations derived formerly (A., 1938, I, 1) is given.   L. S. T.

CN bands in the night sky spectrum. J. CABANNES, J. DUFAY, and J. GAUZIT (Nature, 1938, **142**, 755).—The night sky spectrum appears to contain violet CN bands the intensity of which varies little from the zenith to the horizon.   L. S. T.

Predissociation in the spectra of diatomic molecules. B. GRUNDSTRÖM (Z. Physik, 1938, **111**, 55—60).—The course of predissociation in the C-terms of Ba and Ca hydrides is discussed.   H. C. G.

Application of the new analysis of molecular spectra. H. DESLANDRES (Compt. rend., 1938, **207**, 753—757; cf. A., 1938, I, 435).—An analysis of Raman vv for PCl_3 and PCl_5 is discussed with reference to the excitation of electrons and the grouping of atoms in the mols.   A. J. E. W.

Molecular spectra of halides of the iron group, particularly FeCl. E. MIESCHER (Helv. Phys. Acta, 1938, **11**, 463—468; cf. A., 1937, I, 216, 442).—The spectrum of an electrodeless discharge in $FeCl_2$ vapour contains 8 groups of FeCl bands between 3300 and 3700 A. The principal group (3400—3450 A.) includes the (0, 0) bands of six systems, of which partial analyses are given; all the bands are degraded towards the violet, and two (P and Q) band-heads occur in most cases. Preliminary data for FeBr, indicating a frequency of $\sim$ 310 cm.$^{-1}$, are given. Absorption max. for $FeCl_2$ (2400, 2730), $CoCl_2$ (3000), and $NiCl_2$ (3450 A.) are in accord with the heats of formation.   A. J. E. W.

Absorption spectrum of cobaltous chloride in deuterium oxide. D. C. MARTIN (Nature, 1938,

142, 756).—The absorption curves of anhyd. $CoCl_2$ in H_2O and in 99·6% D_2O show that the mol. extinction coeff. in D_2O is smaller throughout the region of absorption (4000—6000 A.), and the height of the max. is lower.   L. S. T.

Band spectrum of lead fluoride (PbF). II. G. D. ROCHESTER (Proc. Roy. Soc., 1938, **A**, **167**, 567—580; cf. A., 1936, 405).—The band systems are examined in emission and absorption; six new systems are analysed and two continua described. Vibrational consts. are tabulated. The width of the ground state is 8266 cm.$^{-1}$, the highest yet recorded.   G. D. P.

Absorption spectra of solutions of the more important acids of elements of the sulphur group. H. LEY and E. KÖNIG (Z. physikal. Chem., 1938, **B**, **41**, 365—387; cf. A., 1932, 319).—Non-conformity to Beer's law by dil. H_2SO_3 solutions can be explained by the assumption that absorption is due to the more or less hydrated SO_2 mols. The influence of H_2SO_4, Na_2SO_4, and $NaHSO_3$ on the absorption spectrum of aq. solutions of H_2SO_3 in the λ region 2000—3500 A. supports this view. Observations on $NaHSO_3$ and Na_2SO_3 indicate that HSO_3' shows very little absorption, and that previously reported max. in the absorption curves of SO_3'' and HSO_3' do not exist. Only slight continuous absorption is shown by the anions of org. sulphonic acids, S_2O_3'', and S_2O_6''. Continuous absorption, beginning at about 2500 A., is also observed with Na_2SeO_3, $NaHSeO_3$, H_2SeO_3, H_2SeO_4, Na_2SeO_4, and H_6TeO_6.
                    J. W. S.

Structure and absorption spectra of poly-merides of aromatic compounds having a prop-enyl or isopropenyl side-chain. (MLLE.) M. GRUMEZ (Ann. Chim., 1938, [xi], **10**, 378—396).—Absorption spectra are given for $CHPh:CHMe$ and its dimeride (I), b.p. 315°, and metastyrene (II), PhEt, $o\text{-}OH\cdot C_6H_4\cdot CH:CHMe$ and its trimeride (III), o-cresol, $o\text{-}OH\cdot C_6H_4\cdot CMe:CH_2$ and its dimeride (V), $p\text{-}OMe\cdot C_6H_4\cdot CH:CHMe$ and its liquid (VI) and solid (VII) dimerides, p-cresol, $p\text{-}OMe\cdot C_6H_4\cdot CMe:CH_2$ and its dimeride (VIII). These accord with the following structures: (II), (IV), (V), (VI), and (VII) $CHAr{<}^{CHMe}_{CHMe}{>}CHAr$;   (I) $CHPhMe\cdot CH:CHPh$; (III) 2 : 4 : 6-tri-o-hydroxyphenylmesitylene; (VIII) $CMeR:CH\cdot CH_2\cdot CHMeR$ or $CMeR:CH\cdot CMe_2R$ (R = $p\text{-}C_6H_4\cdot OMe$).   R. S. C.

Structure and absorption spectra of o-benzoyl-benzoic acid and derivatives.—See A., 1939, II, 25.

Spectrochemical study of complex colouring matters. Metallic complexes of 2 : 2′-dihydr-oxyazobenzene.—See A., 1939, II, 16.

Modifications in the near infra-red absorption spectra of protein and of light and heavy water molecules when water is bound to gelatin. J. W. ELLIS and (MISS) J. BATH (J. Chem. Physics, 1938, **6**, 723—729).—A detailed account of work already noted (A., 1938, I, 174) and an extension to the influence of D_2O instead of H_2O reveals similarity in effects.   W. R. A.

Vibrational-rotational radiation transitions in water molecules in non-polar solvents. J. W. ELLIS and E. L. KINSEY (Physical Rev., 1938, [ii], **54**, 599—601; cf. A., 1937, I, 443).—Transmission curves showing the 1·875 and 1·379 μ. absorption bands of H_2O mols. in CCl_4 and CS_2 solutions and the 1·985 μ. band of D_2O in CCl_4 are given. They are interpreted as indicating free rotation of H_2O vapour-like mols. in solution; the main feature of each band is an enhanced Q-branch.   N. M. B.

Water of crystallisation in gypsum. J. CABANNES (Compt. rend., 1938, **207**, 700—702).—The ν and polarisation of Raman radiation have been studied for different orientations of a single gypsum crystal. The structure found by Wooster (A., 1937, 1, 17) accounts for two modes of vibration of the H_2O mol. which are symmetrical with respect to the binary axis, and correspond with the observed Raman lines, ν_A 3404 and ν_B 3495 cm.$^{-1}$ The action of the attached O and Ca ions causes displacement from the νν observed in H_2O vapour.   A. J. E. W.

Absorption spectra in the very near infra-red (6000—10,000 A.) of ammonium salts. P. BARCHEWITZ and G. COSTEANU (Compt. rend., 1938, **207**, 722—724).—Aq. NH_4X (X = Cl, I, NO_3, CNS, or NH_4SO_4) gives a H_2O band at 8480 A. and a weak band at ∼ 8160 A. which decreases in intensity on dilution; the latter corresponds with the 3200 cm.$^{-1}$ NH_4 frequency observed in cryst. NH_4 salts. The 8160 A. band is not given by Divers' liquid, possibly owing to masking by a strong NH_3 band. A solution of NH_4CNS in liquid SO_2 (−20°) and fused NH_4NO_3 and NH_4CNS give bands at 8135, 8180, and 8250 A., respectively; no marked change of intensity occurs on diluting the SO_2 solution.   A. J. E. W.

Near infra-red and Raman spectra of ammon-ium salts. (MME.) M. FREYMANN, R. FREYMANN, and Y. TA (Compt. rend., 1938, **207**, 728—731).—Infra-red absorption and Raman νν for cryst., fused, and conc. aq. NH_4NO_3 are reported. The ν (NH) frequencies and their harmonics are observed, but at lower νν than the corresponding NH_3 bands. These frequencies disappear on dilution of the aq. solution, probably owing to displacement of the ionisation equilibrium. Bands at ∼1400 cm.$^{-1}$ which are less intense in aq. NH_4NO_3 probably correspond with valency frequencies.   A. J. E. W.

Infra-red absorption spectrum of some silicates. F. MATOSSI and O. BRONDER (Z. Physik, 1938, **111**, 1—17).—The absorption spectra of 7 silicates and a glass are measured over the range 1—15 μ. and explained as combination frequencies of fundamental vibrations of the SiO_4 tetrahedron. The influence on the spectrum of H_2O content is discussed.   L. G. G.

Molecular structures of carbon and silicon tetrafluorides. C. R. BAILEY, J. B. HALE, and J. W. THOMPSON (Proc. Roy. Soc., 1938, **A**, **167**, 555—567).—Absorption spectra of gaseous CF_4 and SiF_4 have been examined in the infra-red from 1 to 18 μ. The mol. structures are discussed with reference to interat. distances and the extent of electron pair bond formation.   G. D. P.

Infra-red and Raman spectra of polyatomic molecules. III. Ethane. B. L. Crawford, jun., W. H. Avery, and J. W. Linnett. **IV. Allene.** J. W. Linnett and W. H. Avery. **V. cyclo-Propane and ethylene oxide.** J. W. Linnett (J. Chem. Physics, 1938, 6, 682—685, 686—691, 692—702).—III. The Raman and infra-red spectra of C_2H_6 have been re-examined, the Raman spectrum at $-60°$ and the infra-red spectrum of gaseous C_2H_6 from 3 to 15 μ. by a prism spectrometer. Of the four principal Raman lines those at 993, 2900, and 2955 cm.$^{-1}$ are polarised and 1460 cm.$^{-1}$ is depolarised. Results are compared with recorded data; two very faint Raman displacements of 620 and 820 cm.$^{-1}$ are reported. The strong infra-red peak at 1480 cm.$^{-1}$ is single; the existence of a weak infra-red band at 1740 cm.$^{-1}$ has been confirmed. Possible assignments of existing spectral data are made on the basis of the symmetry requirements of the D_{3h} and D_{3d} models. The "uncertain" frequency, indicated by heat capacity data as 1100 cm.$^{-1}$ and by examination of the overtone region as 740 cm.$^{-1}$, is discussed. By accepting a single peak at 1480 cm.$^{-1}$ it is possible to account for all observed νν without using the 740 cm.$^{-1}$ frequency. For both models selection rules are satisfied by assignments based on the existence of a restricting potential of 3000 g.-cal. per mol., an "uncertain frequency" of 1100 cm.$^{-1}$, and an internal torsional oscillation of ~ 300 cm.$^{-1}$ The D_{3h} assignment is slightly more satisfactory but the D_d model is not finally excluded.

IV. The Raman spectrum of allene at $\sim -45°$ consists of ten displacements; the infra-red spectrum of gaseous allene has six intense and three weak bands. The symmetry (V_d) demands seven non-degenerate and four doubly degenerate modes of vibration, divisible into four symmetry classes; four νν appear in Raman effect only and the other seven are common to both spectra. With the aid of heat capacity data, all νν have been assigned and vals. for each of the eleven fundamentals have been ascertained. All observed νν <3000 cm.$^{-1}$ are accounted for as fundamentals, over- or binary combination-tones. The weak infra-red band is supposed to originate from the superposition of several possible ternary combinations. The free energy, entropy, and heat capacity of gaseous allene have been deduced for the temp. range 100—1000° K.

V. Raman and infra-red spectra (from 1·5 to 25 μ.) of cyclopropane (I) and $(CH_2)_2O$ (II) have been determined. The symmetries $[(I) = D_{3h}, \; (II) = C_{2v},]$ selection rules, and spectroscopic activities are given. A complete assignment of all observed νν of (I) has been made, but only a partial assignment of those of (II). The vals. of fundamental νν of (I) and (II) are compared. The free energy, entropy, and heat capacity of (I) have been evaluated from 100 to 1000° K.
                     W. R. A

Partial analysis of some infra-red absorption spectra of organic molecules in dilute solution. O. R. Wulf and (Miss) L. S. Deming (J. Chem. Physics, 1938, 6, 702—711).—The infra-red absorption curves of a no. of mols. containing OH have been analysed on the assumption that the complicated curves in the region of the first overtone of OH are due to superposition of several single curves of varying position and intensity, each of which, in turn, characterises a definite position and orientation of the OH mol. For relatively simple substances this hypothesis is fulfilled. In isomeric benzoinoxime acetates the OH of the β-isomeride appears to occupy two orientations, whilst in the α-isomeride the OH has four orientations, of which two are practically the same as those of the β-form. The no. of possible orientations in β-d-glucose 2 : 3 : 4 : 6-tetra-acetate is discussed; their different orientations appear to confer variability of properties on the substance.
                     W. R. A.

Infra-red absorption spectra (7—20 μ.) of several compounds possessing rings of five or six carbon atoms. J. Lecomte and G. Chiurdoglu (Bull. Soc. chim. Belg., 1938, 47, 429—447).—The absorption spectra of 30 compounds possessing 5- or 6-membered C rings, including saturated and unsaturated hydrocarbons, ketones, and alcohols, have been examined in the region 7—20 μ. The νν are recorded, and an attempt is made to identify them with the modes of vibrations of the mols. The influence of spatial configuration of cis- and trans-isomerides on the positions of the characteristic bands is considered.   W. R. A.

Absorption spectra in the near infra-red (6000 to 11,500 A.) of several compounds possessing rings of five or six carbon atoms. G. Chiurdoglu, P. Barchewitz, and R. Freymann (Bull. Soc. chim. Belg., 1938, 47, 448—460).—The absorption of 30 compounds, including saturated and unsaturated hydrocarbons, ketones, and alcohols, which possess 5- or 6-membered C rings have been examined in the near infra-red. The spectra of stereoisomerides are compared and discussed. A new method of determining the spatial configurations of stereoisomeric tert. cyclanols is based on the observation that the $(OH)_v$ band, found in acyclic saturated alcohols at ~ 9630 A., is displaced towards greater λλ by 40 A. for trans- and by 80 A. for cis-derivatives of cyclanols.   W. R. A.

Infra-red absorption spectra of sugars and furans. L. H. Rogers and D. Williams (J. Amer. Chem. Soc., 1938, 60, 2619—2621).—Spectra between 2 and 12 μ. have been determined for furfuraldehyde, furfuryl and tetrahydrofuryl alcohols, and hydrofuramide, and between 3 and 12 μ. for d- and l-arabinose, d-lyxose, l-xylose, d-galactose, d-mannose, fructose, and glucose. The results are compared with published Raman and infra-red spectral data.   E. S. H.

Band envelopes of unsymmetrical rotator molecules. I. Calculation of the theoretical envelopes. R. M. Badger and L. R. Zumwalt (J. Chem. Physics, 1938, 6, 711—718).—The band envelopes of three elementary types of band of unsymmetrical rotator mols. have been calc. by an approximation method for nine different sets of mol. parameters.   W. R. A.

Raman effect and organic chemistry. K. W. F. Kohlrausch (Ber., 1938, 71, [A], 171—187).—A lecture dealing with the fundamental principles of the

Raman effect, the characteristic frequencies, rotation isomerism, tautomerism, and ring tension.   H. W.

Raman spectrum of thiophosgene. H. W. THOMPSON (J. Chem. Physics, 1938, 6, 748).—$CSCl_2$ liquid gives seven Raman displacements, six of which correspond with fundamental vv.   W. R. A.

Raman spectrum of trialkyl borates. M. MILONE (Gazzetta, 1938, 68, 582—583).—Polemical against Kahovec (A., 1938, I, 386).   O. J. W.

Raman-spectroscopic studies. XIII. Structure of perchloric acid. A. SIMON [with H. REUTHER and G. KRATZSCH] (Z. anorg. Chem., 1938, 239, 329—344).—The prep. of pure anhyd. $HClO_4$ is described. The Raman spectra of 68—100% $HClO_4$ have been determined. The work of Fonteyne (A., 1937, I, 10) is criticised. 100% $HClO_4$ is a pseudo-acid, $HOClO_3$, having a pyramidal structure, symmetry C_{3v}. There are no indications of the existence of an acidium salt such as $[ClO_2(OH)_2]'[ClO_4]'$. On dilution dissociation to ClO_4' and H˙ occurs and is already well-marked in the 97% acid but is not complete even in the fused monohydrate, which in the liquid state is not simply $[OH_3]˙[ClO_4]'$ but still contains some $HOClO_3$. The binding energy for Cl–O in the ClO_4' ion is ~105 kg.-cal. and the force const. 8·1 × 10^5 dynes per cm.   F. J. G.

Raman spectra of acetylenes. I. Derivatives of phenylacetylene, CPh⫶CR. M. J. MURRAY and F. F. CLEVELAND (J. Amer. Chem. Soc., 1938, 60, 2664—2666).—The principal lines for $CPh⫶C·CH_2Cl$, $CPh⫶C·[CH_2]_2·Cl$, $CPh⫶C·[CH_2]_3·Cl$, $CPh⫶C·CH_2Br$, $CPh⫶C·CH_2·OH$, $CPh⫶C·[CH_2]_2·OH$, and $CHPh⫶CH·CH_2Cl$ have been determined, and the structures are discussed.   E. S. H.

Raman effect and dipole moment in relation to free rotation. X. Molecular structure of o-chloroanisole, dimethoxybenzene, and diethoxybenzene. S. MIZUSHIMA, Y. MORINO, and H. OKAZAKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1147—1163).—The Raman spectra and dipole moments of o-$C_6H_4Cl·OMe$, o-, m-, and p-$C_6H_4(OMe)_2$, and p-$C_6H_4(OEt)_2$ have been determined in C_6H_6 and C_6H_{14} and at different temp. The mol. structure of these compounds is discussed. The more stable form of o-$C_6H_4Cl·OMe$ is different in structure from that of o-$C_6H_4Cl·OH$, but it is not possible to decide whether the difference is due to a change in the resonance effect or to steric repulsion between Cl and Me. In o-$C_6H_4(OMe)_2$ the resonance effect is much reduced; its dipole moment varies considerably with temp., indicating that the configuration of the mol. is readily affected by thermal energy. The Raman spectra of p-$C_6H_4(OMe)_2$ and p-$C_6H_4(OEt)_2$ in the solid and liquid states are different, but the spectrum of o-$C_6H_4(OMe)_2$ is the same in both states.   A. J. M.

Debye heat waves in highly viscous liquids. (SIR) C. V. RAMAN and C. S. VENKATESWARAN (Nature, 1938, 142, 791).—A Zn–Hg amalgam lamp in Pyrex glass gives sharp and intense lines at 4680, 4722, and 4811 A. without accompanying hyperfine structure or continuous spectrum. Using this lamp, the light scattered backwards by glycerol (I) and liquid PhOH

at 20° shows well-defined Brillouin components on either side of the incident lines together with a continuous background. The η of (I) appears to have little effect on the propagation of sound waves of high v.   L. S. T.

Relation between fluorescence and chemical constitution in laccol, moreacol, and their derivatives. G. BROOKS (Compt. rend., 1938, 207, 726—728).—Structureless fluorescence bands due to double linkings in the C chain occur at 419—465 mμ. with laccol and moreacol; an additional band at 533—543 mμ. is given by dimethyl- and diacetyl-laccol and -moreacol.   A. J. E. W.

Fluorescent chromium ion in ruby. B. V. THOSAR (Phil. Mag., 1938, [vii], 26, 878—887; cf. A., 1938, I, 495).—Further support is found for the author's previous idea that the fluorescent Cr˙˙˙ ions replace a few Al˙˙˙ ions in the lattice. The intense anti-Stokes bands are due to the superposition of the vibrational frequencies of the Cr_2O_3 thus formed. If the L–S interaction is weak in the ion, the magnetic dissymmetry of the Zeeman pattern is explicable. The validity of the inner quantum no. J and the spin multiplicity are discussed and the lines at λ = 7017 and 7049 A. are shown to be due to transitions between the ^4P levels of the Cr IV and the ^4F levels.   T. H. G.

Electric actions in a system of isotropic bodies. L. ROY (Compt. rend., 1938, 207, 757—759).—Theoretical.   A. J. E. W.

Contact difference of potential between barium and magnesium. P. A. ANDERSON (Physical Rev., 1938, [ii], 54, 753—757).—The electronic method of contact potential measurement was compared with photo-electric work function determinations by measuring the Volta potential Ba–Mg for 30 pairs of surfaces and examining the results in relation to recent precision photo-electric data. General agreement within the limits 1·08—1·16 v. was obtained. Assuming a work function 2·52 e.v. for Ba, the val. for Mg is 3·78 e.v. Observations on the optical reflexion of Mg surfaces suggest the val. 3·65±0·05 for mirror-like surfaces and 3·78 e.v. for macrocryst. surfaces.   N. M. B.

Rectifier action. F. H. MÜLLER (Physikal. Z., 1938, 39, 793—795).—Theoretical. The mechanism of the polarity of Cu_2O rectifiers is discussed.   A. J. M.

Action of soft X-rays on selenium barrier layer cells. A. E. SANDSTRÖM (Phil. Mag., 1938, [vii], 26, 906—920).—These cells respond to soft X-rays (λ 3·5 — 20 A.) in much the same way as to visible light, although in one experiment a remarkable deviation from the linear relationship between current and intensity for low intensities was found. The resistance of the barrier varies in an inexplicable manner. The photo-currents are too small to permit use of the elements for intensity measurements in spectrally dispersed radiation.   T. H. G.

Origin of multiple spectral maxima observed with composite photo-cathodes, on the basis of spectral sensitivity curves. R. SUHRMANN and A. MITTMANN (Z. Physik, 1938, 111, 18—35).—The spectral sensitivity of photo-cathodes consisting of

alkali metal containing traces of alkali hydride or $C_{10}H_8$ or anthracene (I) has been measured at 293° and at 83° K. A sensitivity max. was observed in the visible region in all cases; its position is characteristic of the alkali metal and is shifted toward shorter λ at low temp. Cathodes containing $C_{10}H_8$ show an additional max. between 2900 and 3000 A., the position of which is independent of temp. and of the alkali metal. Cathodes containing (I) show an additional series of short-wave max. The long-wave max. are ascribed to finely distributed, surface-adsorbed alkali metal and the short-wave max. to inner centres in the auxiliary substance.   H. C. G.

Conductivity of solid lead and potassium chlorides. K. VISCHNEVSKA (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 161—173).—The vals. found for sp. conductivity κ of compressed $PbCl_2$ at 160°, 290°, and 300° are closest to those of Seith (A., 1929, 1136). The κ–composition curves of the system $PbCl_2$–KCl, at 290°, 340°, and 360°, suggest the compound $2PbCl_2$,KCl.   R. T.

Pre-breakdown phenomena in insulators and electronic semi-conductors. J. FRENKEL (Physical Rev., 1938, [ii], 54, 647—648).—Mathematical. Phenomena can be explained on the theory that the normal state of the dielectric may be described as a system of neutral atoms rather than of free electrons moving in a self-consistent periodic field of force.   N. M. B.

Dispersion and absorption by polar substances. P. DEBYE and W. RAMM (Nuovo Cim., 1938, 15, 226—231).—A summary of modern views on dispersion and absorption by liquid dielectrics.   O. J. W.

Dipole moment, Raman spectrum, and structure of chlorine heptoxide. R. FONTEYNE (Natuurwetensch. Tijds., 1938, 20, 275—278).—The Cl_2O_7 mol. is dipolar ($\mu_{20} = 0.72 \pm 0.02$ in CCl_4) and angular in structure, consisting of two ClO_3 groups connected through an O bridge, which is bent at an angle of 128°. These conclusions are supported by measurements of the Raman spectrum.   S. C.

Electric dipole moments of diphenyl ether and some derivatives in the vapour phase, and a revision of the oxygen valency angle in these compounds. I. E. COOP and L. E. SUTTON (J.C.S., 1938, 1869—1872).—The dipole moments of Ph_2O and its p-Br-, pp'-Br_2-, pp'-Me_2, p-NO_2-, and p-bromo-p'-methyl derivatives have been determined in the vapour state. The angle between the C–O valencies is calc. to be $124° \pm 5°$, in satisfactory agreement with the val. previously obtained ($128° \pm 4°$) from determinations of the dipole moments in solution.   A. J. M.

Dipole moments of (a) 4 : 4'-dinitro- and 4 : 4'-dicyano-diphenyls, and (b) the isomeric diphenyl-4 : 4'-bisdiazocyanides. R. J. W. LE FÈVRE and H. VINE (J.C.S., 1938, 1878—1882).—The apparent dipole moments of 4 : 4'-dinitro- and -dicyano-diphenyl in C_6H_6 solution are 1.3_2 and 1.0_2, respectively. These moments are to be regarded as anomalous, since the mols. have axial symmetry. The dipole moments of the isomeric diphenyl-4 : 4'-bisdiazo-

cyanides have been determined, the two forms being shown to be geometrical isomerides. The less stable form is either the cis-cis or the trans-cis form. The spontaneous isomerisation of the less stable form has been followed by observations of dielectric const., and appears to be unimol.   A. J. M.

Refraction, dispersion, and related properties of pure hydrocarbons arranged for use in the analysis of hydrocarbon mixtures. A. L. WARD and S. S. KURTZ, jun. (Ind. Eng. Chem. [Anal.], 1938, 10, 559—576).—The following data are tabulated for members of the different hydrocarbon series boiling between 10° and 200° or slightly higher : b.p. at 760 or 10 mm., d_4^{20}, n_D^{20}, dispersion, the refractivity intercept, and sp. dispersion. Tables showing averaged data for specified boiling ranges are given, and curves based on these averaged properties are drawn. The relationship between ρ and n for groups of paraffin and olefine isomerides is represented graphically. The effect of temp. and pressure on ρ and n is discussed. 177 references to the lit. are given.   L. S. T.

Rotatory dispersion in the amine series. IV. Optical activity of diamines. W. C. G. BALDWIN (Proc. Roy. Soc., 1938 A, 167, 539—554).—The changes in [α] which occur on neutralisation are used to detect induced dissymmetry in the NH_2-radical of optically active bases. The rotatory dispersion of cryst. $(CH_2 \cdot NH_2)_2$,H_2SO_4 is compared with that of $CH_2(CH_2 \cdot NH_2)_2$, 1-diaminocyclohexane, and of their salts in solution. The results are interpreted in terms of Boys' molecular model and the configuration of $CH_2(CH_2 \cdot NH_2)_2$ is defined.   G. U. P.

Relation between the degree of depolarisation of molecularly scattered light in liquids, and the Kerr constant. H. A. STUART and W. BUCHHEIM (Z. Physik, 1938 111, 36—45).—The ratio of B (observed) and B, calc. from measurements of the degree of depolarisation on liquids by means of the Gans equation, is ± 1. The deviations are outside experimental error and attempts are made to explain them theoretically.   L. G. G.

Variation with temperature of electrical and magnetic double refraction of liquids. K. H. GRODDE (Physikal. Z., 1938, 39, 772—783).—The electrical and magnetic double refraction of some org. liquids has been determined at temp. between 20° and 170°. The results are compared with the theory of Langevin, Born, and Gans, which holds only for gases. The Kerr effect is not greatly affected by temp., decreasing a little with increase of temp. The Cotton–Mouton const., however, decreases to a greater extent with increase of temp. Polar liquids show a greater decrease than theoretical with rising temp. The results are discussed.   A. J. M.

Stereochemistry of quadricovalent atoms : thallium. E. G. COX, A. J. SHORTER, and W. WARDLAW (J.C.S., 1938, 1886—1888).—X-Ray analysis of tetrakisthioureathallous nitrate and chloride indicates that if these are 4-co-ordinated compounds of the type $[TlR_4]X$, the four valencies of Tl are coplanar, or nearly so. Dimethylthallic acetylacetone has also been investigated. The four valencies of Tl

in this compound are arranged tetrahedrally, as would be expected since the effective at. no. is 86 (*i.e.*, that of Rn). A. J. M.

Molecular potential curves from spectroscopic data. A. S. COOLIDGE, H. M. JAMES, and E. L. VERNON (Physical Rev., 1938, [ii], 54, 726—738).—Mathematical. A crit. examination of the accuracy of various methods leads to preference for a method of successive approximations. Formulæ for the treatment of potential curves of various types are obtained, and results are illustrated by reference to the lowest $^3\Sigma_g$ state of H_2. N. M. B.

Systematics of band-spectral constants. IV. Inter-relation of equilibrium vibration frequency and distance for diatomic nuclei in ground and excited states. C. H. D. CLARK and J. L. STOVES (Trans. Faraday Soc., 1938, 34, 1324—1328; cf. A., 1937, I, 602).—The formula proposed (*ibid.*, 67) gives better correlation with experimental data than does that of Huggins (A., 1936, 781). E. S. H.

Calculation of the frequencies of the symmetrical modes of vibration for molecules with various types of symmetry. H. J. BERNSTEIN (J. Chem. Physics, 1938, 6, 718—722).—Secular equations for the vv of the symmetrical modes of vibration of mols. possessing various symmetries have been set up and applied to the structure of oximes. Acetoxime is planar and has the structural formula

$$126° \quad \begin{matrix} Me \\ Me \end{matrix} \!\!> C\!:\!N\!\cdot\!OH.$$
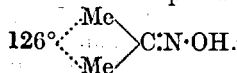
W. R. A.

Potential energies of the alkali halides : errata and extension of the semi-empirical formula. A. MAY (Physical Rev., 1938, [ii], 54, 629—633).—Previous calculations for CsCl (cf. A., 1937, I, 552) are corr. Six consts. in the potential energy expression for CsCl are evaluated from data on the lattice and vapour, and from the results, applied to other halides, interionic distances in the gas, lattice energies, and heats of sublimation are determined. Agreement with experimental data is satisfactory for the first, and poor for the two last-named. N. M. B.

Ordering and transformations in condensed phases. F. C. FRANK and K. WIRTZ (Naturwiss., 1938, 26, 687—693, 697—705).—A review. The thermodynamic classification of transformations is discussed, and examples of various transformations are given, *e.g.*, that of the second kind in the case of He, and the rotational transformations of CH_4 and CD_4. The course of different transformations is considered. The problem is also dealt with from the mol. viewpoint. Liquid crystals, superstructural transformations, and the phenomenon of fusion are considered. A. J. M.

Ordering and transformations in condensed phases. M. VON LAUE (Naturwiss., 1938, 26, 757).—An addition to a paper by Frank *et al.* (preceding abstract). A. J. M.

Statistical theory of superlattices with long-range interaction. I. General theory. II. The simple cubic lattice and the body-centred cubic lattice. J. S. WANG (Proc. Roy. Soc., 1938, A, 168, 56—67, 68—77).—I. Bethe's theory is extended to include long-range interactions.

II. The results are applied to the simple and body-centred cubic lattices and effect an improvement in the agreement of theory and experiment. G. D. P.

Relation between surface tension and internal heat of vaporisation. O. ALBERT and F. EIRICH (Z. physikal. Chem., 1938, 183, 9—18).—The change in the ratio between heat of vaporisation and surface tension with mol. wt. and temp. is discussed in relation to theories of mol. orientations in surface layers. Surface energy, to which free and internal energy contribute, increases more slowly than heat of vaporisation with increase in chain length. Data for nonoic, nonenoic, and oleic esters are recorded. C. R. H.

Organic parachors. I. Parachors of a series of isomeric esters. O. R. QUAYLE, (MISS) K. OWEN, and R. R. ESTES (J. Amer. Chem. Soc., 1938, 60, 2716—2719).—Parachors of the complete series, $H\cdot[CH_2]_x\cdot CO_2\cdot[CH_2]_y\cdot Me$ ($x + y = 14$), are measured at 26°, 35°, 50·5° (or 50°), and 65°. Parachors and mol. vols. vary gradually, being a min. for n-$C_5H_{11}\cdot CO_2C_8H_{17}$-$n$. In general parachors increase with temp. R. S. C.

Increase of X-ray reflexion from quartz due to a strong electric field. Y. KAKIUCHI (Physical Rev., 1938, [ii], 54, 772).—The intensity of reflexion increases with duration of application of the field to a max. after several hr. of application. The effect is strongly structure-sensitive, and dies away very slowly after removal of the field, but more rapidly at high temp. or under irradiation with X-rays or γ-rays. Explanations are discussed. N. M. B.

Order versus disorder in ternary structures including certain spinels. F. C. BLAKE (J. Chem. Physics, 1938, 6, 630—635).—The doubling process suggested by Laue (Ann. Physik., 1918, 56, 497) has been employed in studying Li ferrite. All superlattice lines disappear when the lattice edge is 8 times that of the small disordered lattice of Posnjak and Barth (A., 1936, 830). The simple space-group O_h^7 of this large (33 A.) lattice gives only face-centred lines on the powder photograph. The disappearance of the superlattice lines for this lattice may be due to the coherence of the X-rays which cause the destructive interference involved. W. R. A.

X-Ray test of superstructure in $FeNi_3$. F. E. HAWORTH (Physical Rev., 1938, [ii], 54, 693—698).—In view of strong indirect evidence of superstructure, the specimen of approx. composition $FeNi_3$, and containing 70% Ni, was placed in a focussing camera in a beam of Fe $K\beta$-rays, which should give the strongest superstructure lines, and exposed for 100 hr. No superstructure lines appeared, and the negative result indicates that no long-range order exists in $FeNi_3$. N. M. B.

Barker's systematic crystallography. P. TERPSTRA and W. J. VAN WEERDEN (Natuurwetensch. Tijds., 1938, 20, 285—293).—Barker's directions for the systematic description of triclinic crystals are insufficient. 552 configurations are possible, corre-

sponding with 202 different complexes of which 94 are ambiguous. The 202 complexes have been tabulated on Groth's system. A simple and convenient form of goniometer manufactured by Stoe, Heidelberg, is illustrated.   S. C.

Atomic distribution in the allotropic forms of phosphorus at different temperatures. C. D. Thomas and N. S. Gingrich (J. Chem. Physics, 1938, 6, 659—665).—Monochromatic X-ray diffraction patterns of liquid yellow P, amorphous red P, and amorphous black P have been obtained using Mo $K\alpha$ radiation, and the effect of temp. on the patterns of the two first forms has been investigated. Analysis of the patterns gave the at. distribution curves, which indicate that for all forms the no. of nearest neighbours is 3, i.e., P is present in all forms as P_4.   W. R. A.

Lattice distortions in pyrophoric metals. I. II. Lead and nickel. G. R. Levi and G. Rossi (Gazzetta, 1938, 68, 570—576, 576—581).—I. The quant. determination of lattice distortions from Debye–Scherrer photographs (cf. Brill, A., 1937, I, 399) is discussed and sources of error are pointed out. Measurements with pyrophoric Fe agree with those of previous workers.

II. X-Ray measurements with ordinary and pyrophoric Pb show that the lattice distortion in both forms is small and approx. equal. Ordinary Ni shows no lattice distortion, whereas pyrophoric Ni shows a mean distortion of 0·16 A. The pyrophoric behaviour is due to lattice distortion in the case of Ni but not of Pb.   O. J. W.

Growth of a magnesium crystal in its vapour. S. Sakui (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1131—1146).—Rapid growth of Mg crystals from Mg vapour occurs at a temp. as high as possible but < the m.p. and at a place of high v.d. The higher is the temp. the larger the crystal grows. The most favourable pressure is 0·8—2·7 mm.   A. J. M.

Crystal structure of Co_2Al_5. A. J. Bradley and C. S. Cheng (Z. Krist., 1938, 99, 480—487).—From powder X-radiograms, the hexagonal cell, with 4 Co_2Al_5, has a 7·656₀, c 7·593₂ A.; ρ 4·14; space-group D_{6h}^4—$C6/mmc$. Complete at. parameters derived from abs. intensities by the use of structure factor graphs, figure fields, and Fourier synthesis, yield a 4-sheet structure of puckered hexagonal rings. Interat. distances indicate a new type of structure.   I. McA.

X-Ray analysis of the structure of water. J. Morgan and B. E. Warren (J. Chem. Physics, 1938, 6, 666—673).—Monochromatic X-ray diffraction patterns of H_2O have been obtained at 1·5°, 13°, 30°, 62°, and 83°, using Cu $K\alpha$ and Mo $K\alpha$ radiations. The distribution curves do not yield quant. information on the structure of H_2O, but indicate that the tendency of the H_2O mol. to link itself tetrahedrally to 4 neighbouring mols. is only partly satisfied.
          W. R. A.

Some sulphides obtained by decomposition of the corresponding thiosulphates. D. Ghiron (Gazzetta, 1938, 68, 559—566).—The structures of the sulphides of Pb, Ni, Cu, Zn, and Cd, obtained from the thermal decomp. of the corresponding thiosulph-

ates, have been studied by X-rays. Only PbS is obtained in a pure state. The sulphides of Pb, Zn, and Cu have the structures of galena, blende, and covellite, respectively; that of Ni has the composition NiS_2 and a pyrites type structure.   O. J. W.

Structures of molybdenum pentachloride and tungsten hexachloride. R. V. G. Ewens and M. W. Lister (Trans. Faraday Soc., 1938, 34, 1358—1362).—Electron-diffraction investigation of the vapour shows that $MoCl_5$ is a trigonal bipyramid, with Mo—Cl 2·27±0·02 A., and WCl_6 a regular octahedron with W—Cl 2·26±0·02 A.   E. S. H.

Structure of pale yellow crystalline basic mercuric chloride, $HgO,2HgCl_2$. G. Gawrych (Rocz. Chem., 1938, 18, 217—219).—The crystals belong to the cubical system. The elementary cell, containing 4 $HgO,2HgCl_2$ mols., has a 9·211±0·009 A.   R. T.

Crystal structure of potassium fluorochromate. J. A. A. Ketelaar and (Frl.) E. Wegerif (Rec. trav. chim., 1938, 57, 1369—1275).—The dimensions of tetragonal $KCrO_3F$ are a 5·46±0·01, c 12·89±0·02 A., $a : c$ 1 : 2·36; space-group C_{4h}^6. From a determination of the at. distances, the probable structure is shown to be of scheelite type.   C. R. H.

Crystallography and certain other physicochemical properties of potassium lead copper hexanitrite. J. E. Mackenzie and R. L. Smith (Rec. trav. chim., 1938, 57, 1211—1217).—$K_2PbCu(NO_2)_6$ crystallises in the cubic system, class 32; n is ≮1·8. The ionisation of the salt in solution increases with dilution.   C. R. H.

Structure of ammonium heptafluozirconate and potassium heptafluozirconate and the configuration of the heptafluozirconate ion. G. C. Hampson and L. Pauling (J. Amer. Chem. Soc., 1938, 60, 2702—2707).—X-Ray evidence shows that $(NH_4)_3ZrF_7$ has a holohedral face-centred cubic unit, with a_0 9·365 A., containing 4 simple mols. K_3ZrF_7 has a similar structure with a_0 8·95 A. The proposed structure involves some random distribution of atoms among positions provided by the space-group O_h^5, and is closely related to that of $(NH_4)_3AlF_6$; AlF_6''' is replaced by ZrF_7''', in which the co-ordination no. of Zr is 7.   E. S. H.

Structure of olivenite, $Cu_2(OH)AsO_4$. H. Heritsch (Z. Krist., 1938, 99, 466—479; cf. A., 1938, I, 421).—The corr. space-group is D_{2h}^{12}, an anomalous reflexion being due to indirect excitation (A., 1937, I, 117, 446; 1938, I, 179). After interchange of a and b axes, at. parameters and interdistances determined in accord with listed X-ray intensities establish a structure similar to those of adamine and andalusite (Strunz, A., 1936, 1483). Optical data are recorded and the structures compared.   I. McA.

Crystal structure of some ferricyanides with bivalent cations. A. K. van Bever (Rev. trav. chim., 1938, 57, 1259—1268).—The determination of the at. distances and the crystal structure of $M_3[Fe(CN)_6]$ (M = Cd, Mn, Zn, Co, Cu, and Ni) and of $Fe[Fe(CN)_6]$ is described. After drying at 86° for 3 hr., 1 mol. of the compounds contains approx. 8 mols.

of H_2O, which is reduced to approx. 2 mols. of H_2O after further drying in vac. The intensity ratios of the X-ray reflexions remain unchanged during drying, and no change in cell dimensions has been observed. It is argued that in the " dry " crystal powder, H_2O remains enclosed between the crystal particles and not within the lattice.   C. R. H

Electron-diffraction investigation of chromium, molybdenum, and tungsten hexacarbonyls. L. O. Brockway, R. V. G. Ewens, and M. W. Lister (Trans. Faraday Soc., 1938, **34**, 1350—1357).— Recorded data for interat. distances (in A.) are: $Cr(CO)_6$, Cr—C $1·92\pm0·04$, Cr—O $3·08\pm0·05$, C—O $1·16\pm0·05$; $Mo(CO)_6$, Mo—C $2·08\pm0·04$, Mo—O $3·23\pm0·05$, C—O $1·15\pm0·05$; $W(CO)_6$, W—C $2·06 \pm0·04$, W—O $3·19\pm0·05$, C—O $1·13\pm0·05$. The mol. model is represented by a regular octahedron with the metal atom at the centre and the CO groups directed towards the apices.   E. S. H.

Enlargement of lattice of cellulose hydrate by absorptive linking of water. I. Sakurada and K. Hutino (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1164—1173).—Cellulose hydrate undergoes a small reversible lattice change on rapid drying. By adsorptive linking of H_2O the separation of the (101) planes is increased by $0·3$ A., and the vol. of the elementary cell increased by about 4%. Other planes are not appreciably affected.   A. J. M.

Orientation of high mol. wt. linear polymerides in unstretched films. G. H. Young, W. K. Schneider, and J. G. Aston (J. Amer. Chem. Soc., 1938, **60**, 2825—2826).—Recent observations (A., 1938, I, 503) confirm Young's theory of partly oriented film structure (B., 1938, 940).   E. S. H.

Electron-diffraction effects from polished zinc surfaces. M. L. Fuller (Amer. Inst. Min. Met. Eng., Tech. Publ. 965, 1938, 11 pp.; Met. Tech., 1938, **5**, No. 6).—In certain circumstances polished Zn surfaces have been found to yield electron-diffraction effects which indicate the surface to be definitely cryst. These effects are in the form of diffraction lines perpendicular to the shadow edge of the reflexion type of photogram. It is surmised that the polished surface consists of minute Zn crystals oriented with their basal planes parallel to the plane of polish. Experimental evidence shows that the diffuse halo pattern alone has no significance with respect to the composition and cryst. structure of a surface, and that whether or not such a diffraction pattern is obtained depends on the surface texture of the specimen.   R. B. C.

Relation of ferromagnetic anisotropy to atomic structure. L. W. McKeehan (Physical Rev., 1937, [ii], **51**, 1010).—Ferromagnetic atoms of Fe, Co, and Ni are assigned simple distributions of magnetic moment consistent with what is known concerning the $3d$ electrons in these atoms. The resultant anisotropy calc. for the observed cubic and hexagonal arrangements agrees with experimental results concerning these metals and their alloys.   L. S. T.

Magneto-electrolytic anisotropy. A. Perrier and C. Mermod (Helv. Phys. Acta, 1938, **11**, 468— 469).—Specimens of Fe and Ni possessing a high

stable anisotropy have been prepared by electrodeposition in a magnetic field.   A. J. E. W.

Variation in the longitudinal incremental permeability due to a superimposed circular field. J. S. Webb (Nature, 1938, **142**, 795).—Large increases in this permeability of a Fe–Ni wire serving as the core of a solenoid occur when a d.c. is passed through the wire to produce a superimposed circular field. Graphs showing the variation of the inductance of the solenoid as a function of the d.c. through the conducting core, and the variation of the longitudinal incremental permeability as a function of the degree of twist of the core, are reproduced.   L. S. T.

Single crystals with exceptionally high magnetic permeabilities. P. P. Cioffi, H. J. Williams, and R. M. Bozorth (Physical Rev., 1937, [ii], **51**, 1009).—Single crystals of purified Fe and of an Fe– Ni alloy (66% Ni) having max. permeabilities of 680,000 and 1,040,000, respectively, have been prepared. The combination of factors necessary for the attainment of high permeability is given.   L. S. T.

Behaviour of extremely thin metallic films under various conditions. M. Kindinger and K. Koller (Mikrochim. Acta, 1938, **3**, 317—325).—A review. The physical, electrical, and optical properties of very thin metallic films are compared with those of the metals in bulk. Theories to account for these properties and their changes on ageing are summarised and discussed.   J. W. S.

Transformations of organic compounds in the solid state (long-chain compounds). I. Stearic acid. P. A. Thiessen and C. Stüber (Ber., 1938, **71**, [*B*], 2103—2123).—The course of the $\beta \rightarrow \alpha$ transformation in stearic acid has been investigated by observations on the double refraction and on ϵ (apparatus for the measurement of which is described). The transformation is irreversible under ordinary pressure, but the β-form is not totally unstable. The change is slow but complete at 46°, whilst in the range 43—46° it is only partial, and below 40° it never occurs even on prolonged tempering. On crystallising below 40°, the β-form is deposited from C_6H_6 and xylene, the α-form from AcOH, PhCl, and ligroin, and a mixture from *p*-cymene, PhMe, and EtOH.   F. J. G.

Physico-chemical revision of mol. and at. wts. New results. E. Moles (Bull. Soc. chim. Belg., 1938, **47**, 405—428).—The method of limiting densities is revised and discussed, and various precautions are indicated which must be taken to ensure accuracy. The following at. wts. have been determined : N = $14·0083$, C = $12·007$, S = $32·0635$, and F = $18·995$.   W. R. A.

Electrical conductivity of the transition metals. A. H. Wilson (Proc. Roy. Soc., 1938, **A**, **167**, 580— 593).—A theoretical investigation of the s–d transitions, in a metal containing incomplete d-bands, shows that these should fall exponentially as the temp. is lowered. A suggestion is put forward to explain the change of sign of the thermo-electric power of Pt at low temp.   G. D. P.

Influence of magnetic fields on persistent currents in a closed superconducting circuit. K. C. MANN, H. G. SMITH, and J. O. WILHELM (Physical Rev., 1938, [ii], 54, 758—766).—Experiments on Sn show that no resistance appears until the mean magnetic induction within the specimen becomes considerable. Results are markedly influenced by the presence of traces of impurities.   N. M. B.

Relaxation effects connected with the transition between the superconducting and normal states. H. G. SMITH and K. C. MANN (Physical Rev., 1938, [ii], 54, 766—770).—The relaxation effects are similar to those found in a closed superconducting circuit (cf. preceding abstract), and confirm the view that they are due to the slow decay, caused by a very small resistance, of eddy currents in the specimen. It is shown thermodynamically that the same cause will produce relaxation in the thermal equilibrium, accounting for observed time effects in calorimeter experiments.   N. M. B.

Physical phenomena at the temperature of liquid helium. E. F. BURTON (J. Appl. Physics, 1938, 9, 489—499).—A review of recent work at very low temp., with special reference to experiments on anomalous properties of liquid He II, and electrical and magnetic properties of superconducting metals.   J. A. K.

Magnetic studies on rhodochrosite, $MnCO_3$. K. S. KRISHNAN and S. BANERJEE (Z. Krist., 1938, 99, 499—508).—From measurements on $MnCO_3$ (96% corr.), the mean molar susceptibility (χ) is given as a function of temp. by $\chi = 3\cdot81/(T + 13)$; the consts. corroborate theory for Mn`` ions. The feeble anisotropy (0·06% of $\chi$), corroborating Tutton's vals. for Mn`` salts, corresponds with a Stark splitting of the Mn`` s levels of ~0·07 cm.$^{-1}$ Results are discussed.   I. McA.

Velocity of sound. R. C. COLWELL and A. W. FRIEND (Science, 1938, 88, 244).—Using a relatively short base line and an oscilloscope the val. obtained is 331·57 m. per sec. at 0°.   L. S. T.

Dispersion of ultrasonic waves in liquids. R. BÄR (Helv. Phys. Acta, 1938, 11, 472—475).—No dispersion can be detected from measurements of the velocity of sound in H_2O and EtOAc at ~20°, using frequencies of 7·5 and 53 Mc. per sec.   A. J. E. W.

Influence of ultrasonics on the discharge potentials of hydrogen, oxygen, and chlorine. R. PIONTELLI (Atti R. Accad. Lincei, 1938, [vi], 27, 581—586; cf., A., 1938, I, 486).—Further evidence of the depolarising action of ultrasonics on discharge potentials at various electrodes and in various electrolytes is described.   O. J. W.

Thermodynamic scale of temperature. N. KÜRTI and F. SIMON (Phil. Mag., 1938, [vii], 26, 840—849).—The growing use of the thermodynamic scale as a consequence of the magnetic method of reaching extremely low temp. (<1° K.) has led to the use of "provisional temp." T^* obtained from the magnetic susceptibilities by extrapolating Curie's law into the unknown regions. This gives wrong results. Other methods are discussed and a new

procedure is described in which it is not necessary to determine the amount of heat supplied to the system, or to measure any property of the substance which characterises its state in the additional field. It can be used particularly for correlation of abs. temp. in an additional field and in zero field, for studying the Curie point, or for measuring the abs. temp. of some point in the system.   T. H. G.

"Curie" scale of temperature. N. KÜRTI and F. SIMON (Phil. Mag., 1938, [vii], 26, 849—854; cf. preceding abstract).—In the region obtained by the magnetic method, the "temp." is usually determined by measuring the susceptibility of the salt and extrapolating it according to Curie's law. It is shown that although the relation between susceptibility and $1/T$ is linear for salt specimens of all shapes at the temp. of liquid He, considerable deviations occur at very low temp. An unambiguous definition of the "Curie" scale is therefore suggested in which reference is made to a sphere as the standard shape.   T. H. G.

Latent heat of fusion of aluminium. J. H. AWBERY (Phil. Mag., 1938, [vii], 26, 776—784).—Published vals. show a max. difference of about 50% and fall into two groups with mean vals. ~92 and ~77 g.-cal. per g. The electrical energy required to melt a known mass has now been measured and gives a result of 91 g.-cal. per g. The most probable val. is 92·4.   T. H. G.

Specific heat of water (H_2O) between 0° and 100°. W. A. ROTH (Z. physikal. Chem., 1938, 183, 38—42).—From vals. for the sp. heat, c, of D-free H_2O the following empirical equations have been derived : $c = 1\cdot0066 - 0\cdot_3 56960 + 0\cdot_5 87420^2$ between 0° and 40°, and $c = 0\cdot9989 - 0\cdot_3 1110 + 0\cdot_6 18890^2$ between 40° and 100°.   C. R. H.

Exact measurements of the specific heat of solid substances at high temperatures. X. Specific heat, electrical resistance, thermoelectrical behaviour, and thermal expansion of some rare-earth metals. F. M. JAEGER, J. A. BOTTEMA, and E. ROSENBOHM (Rec. trav. chim., 1938, 57, 1137—1182).—Ce and La both exist in four modifications, but at any one temp. several of these modifications co-exist simultaneously. On account of the slow rate of change from one modification to another, the exact transition temp. cannot be ascertained. Each modification is truly stable only within a very limited temp. range, and is characterised by highly discrepant vals. of the temp. coeff. of its electrical resistance. The at. heats of both metals are $>3R$ g.-cal. at low temp. Nd is even more complex in its behaviour since it exhibits a remarkable cyclic hysteresis effect if successively heated and cooled near the β–γ transition temp., approx. 508°. Like Ce and La, Nd has an at. heat $>3R$ g.-cal. at low temp. Didymium, the solid solution of Pr and Nd, has similarly been examined.   C. R. H.

Free-energy relations among the paraffin and olefine hydrocarbons. G. S. PARKS (Chem. Rev., 1936, 18, 325—334).—Among the paraffin hydrocarbons the free energy increases with increasing length of chain, and with increased branching in a

group of isomerides. In the olefines the position of the double linking and geometric isomerism are also important factors. Ch. Abs. (e)

Nuclear spin and symmetry effects in the heat capacity of ethane gas. E. B. Wilson, jun. (J. Chem. Physics, 1938, 6, 740—745).—A detailed account of work already noted (cf. A., 1938, I, 438).
W. R. A.

Liquids. N. Bârbulescu (Bul. Soc. Stiinte Cluj, 1936, 8, 462—476; Chem. Zentr., 1937, i, 5).—Integration of the Clausius–Clapeyron equation between the temp. limits T_e (the abs. b.p.) and T_c gives the relation $L = 4.571 \log p_c\{T_cT_e/(T_c - T_e)\}$. The calc. vals. of L for H_2, N_2, O_2, NH_3, H_2O, and a no. of org. liquids are in good agreement with experiment. Vals. of van der Waals' consts. are deduced, the derived mol. diameter vals. agreeing with those calc. from $[R]$. The square of the sp. mol. attraction is an additive property of chemical compounds.
A. J. E. W.

Densities of fine powders. II. J. L. Culbertson and M. K. Weber (J. Amer. Chem. Soc., 1938, 60, 2695—2697; cf. A., 1937, I, 175).—Measurements with finely divided SiO_2 and C in different liquids show that polar liquids yield high d vals. for SiO_2 and non-polar liquids yield low vals. Higher vals. are obtained for C in the more compressible liquids. Polar liquids with large compression coeffs. yield high d vals. for SiO_2 and C. Measurements with SiO_2 powders of different particle size in C_6H_6 and in H_2O indicate that the degree of penetration of liquids into the solid surface has little influence on the variations of apparent d. E. S. H.

Reflexion coefficient of mercury. R. C. Mason (J. Appl. Physics, 1938, 9, 535—539).—Two methods for measuring the reflexion coeff. of Hg atoms from a Hg surface are described : (i) change of pressure on the surface when exposed near a liquid-air-cooled target is measured by a micromanometer; (ii) the v.d. between evaporating and condensing surfaces is measured by an ionisation gauge. A reflexion coeff. of 0·07 was found with carefully purified Hg but after exposure to air the reflexion rose to 0·8. The val. for ordinary " clean " Hg is 0·92—0·99.
J. A. K.

Rate of vaporisation of mercury from an anchored cathode spot. L. Tonks (Physical Rev., 1938, [ii], 54, 634—639).—Difficulties due to spray are eliminated by use of an anchored cathode spot, and those due to normal evaporation from the free surface by confining the spot to a very small area. This is achieved by the special water-cooled cathode structure described. By means of a calibrated feed mechanism, Hg is fed to the cathode as fast as it vaporises. Measurements over a range show a rate of vaporisation increasing with arc current, temp., and exposed area. The rate, extrapolated to zero arc current, is approx. 2.5×10^{-4} g. per coulomb.
N. M. B.

Calculation of thermodynamic functions from spectroscopic data. L. S. Kassel (Chem. Rev., 1936, 18, 277—313).—A review. Ch. Abs. (e)

Effusion phenomena in relativistic quantum statistics. B. N. Srivastava (Proc. Roy. Soc.,

1938, A, 167, 516—526).—A theoretical investigation of effusion in non-degenerate and degenerate matter; both Fermi–Dirac and Bose–Einstein statistics are considered. G. D. P.

Viscosity of light hydrogen gas and deuterium between 293° and 14° K. A. van Itterbeek and (Miss) A. Claes (Nature, 1938, 142, 793—794).—Data obtained by the oscillating-disc method are recorded. At room temp., the ratio $\eta_{D_2} : \eta_{H_2}$ is $\propto$ to the ratio of (mol. wts.)$^{\frac{1}{2}}$, but at lower temp. the ratio decreases regularly. L. S. T.

Viscosity of aniline between 20° and 100°. L. A. Steiner (Ind. Eng. Chem. [Anal.], 1938, 10, 582—584).—The η of vac.-distilled NH_2Ph, d_4^{20} 1·0208 ±0.0003, d_4^{100} 0·9527±0.0003, has been determined at 5° intervals from 20° to 100° with an accuracy of ±0.20 to $\pm0.30\%$. At 20°, η is 4·400$\pm0.25\%$ centipoises. The results are compared with those given in the lit. NH_2Ph is more suitable than H_2O for the calibration of viscosimeters at high temp. When protected from light and the atm., it remains unchanged for 2 months. L. S. T.

Internal friction and internal lubrication. H. Harms, H. Rössler, and K. L. Wolf (Z. physikal. Chem., 1938, B, 41, 321—364).—A mol. theory of internal friction is developed in which the mol. viscosity of a liquid mixture is related to the mol. viscosities of the pure components and their mol. vols. in the mixture. The theory is tested by application to a series of measurements on mixtures of C_6H_6 and C_6H_{14} with cyclohexane, CCl_4, and $COMe_2$, CS_2 with CCl_4, and of various alcohols with C_6H_6, CCl_4, cyclohexane, CS_2, and dioxan. Deviations from the theory are discussed with reference to changes in intermol. forces and the depolymerisation of polar mols.
J. W. S.

Vapour pressure of saturated aqueous sucrose at low temperatures. K. P. Volkov and E. A. Savostianov (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 103—120).—The v.p. of saturated aq. sucrose, determined for the range 13·7—43°, is expressed by Bertrand's formula $P = G\{(T - \lambda)/T\}^{50}$ ($\lambda = 75.62$, $\log G = 7.65013$); Raoult's and Speransky's formulæ are not applicable. The integral heat of dissolution of sucrose is 284·1 g.-cal. at 22°. R. T.

Solutions of sodium in liquid ammonia; magnetism, thermal expansion, state of the dissolved sodium. E. Huster (Ann. Physik, 1938, [v], 33, 477—508; cf. A., 1937, I, 137).—The density of solutions of concn. 0·01—0·17 mol. fraction Na have been measured between —34° and —75°. The magnetic susceptibility (χ) of the solutions has been determined at —35° and —75°. The general variation of χ with concn. agrees with the theory that the dissolved Na is in the metallic state at all concns. (cf. A., 1932, 1206). Deviations at low and medium concns. can be explained by the presence of Na_2 mols. The conclusions of Krüger (A., 1938, I, 572) are criticised. O. D. S.

Sp. gr. of pure and mixed salt solutions in the temperature range 0—25°. R. W. Bremner, T. G. Thompson, and C. L. Utterback (J. Amer. Chem. Soc., 1938, 60, 2616—2618).—Data are

recorded for aq. NaCl, KCl, $MgSO_4$, NaCl + KCl, NaCl + $MgSO_4$. Concns. of the binary solutions were in the same ratios as those that occur in ocean-H_2O. Root's equation (A., 1933, 347) is applicable to the results; the appropriate consts. for the above solutions have been calc.   E. S. H.

Densities of aqueous solutions of carbamide at 25° and 30° and the apparent molal volume of carbamide. F. T. GUCKER, jun., F. W. GAGE, and C. E. MOSER (J. Amer. Chem. Soc., 1938, 60, 2582—2588).—Data for 0·1—4M. solutions at 30° and 0·1—9·5M. at 25° are recorded. The apparent mol. vol. of $CO(NH_2)_2$ is a linear function of the vol. concn. over the range examined at 30° and up to 3M. at 25°. Equations relating apparent mol. vol. and d to concn. are given. Solid $CO(NH_2)_2$ has d 1·329 g. per ml. at 25°, mol. vol. 45·19 ml.
E. S. H.

Compressibility and solvation of solutions of electrolytes. A. PASSINSKI (Acta Physicochim. U.R.S.S., 1938, 8, 385—418).—A formula for the solvation of electrolytes in terms of the compressibility (κ) of their solutions is given, and a method for determining the κ of electrolyte solutions from measurements of the velocity of propagation of ultrasonic waves is described. Data recorded for aq. LiCl (6), LiBr (5), NaF (9), NaCl (8), NaBr (7), NaI (7), KF (9), KCl (7), KBr (7), KI (6), $BeCl_2$ (9), $MgCl_2$ (17), $BaCl_2$ (16), and $AlCl_3$ (31) over a wide range of concn. show that the variation of κ of electrolytes with concn. is nearly linear, and almost independent of the ionic radii. It is $\propto$ the no. of ions in solution and to their (charge)$^{1·5}$. In the main, the results substantiate Debye's theory of compressibility. The calc. solvation vals. decrease somewhat with a rise in concn. Extrapolation to infinite dilution gives the limiting vals. recorded above in parentheses. The solvation of cations follows the series Li$^•$ < Na$^•$, K$^•$, and of anions F′ > Cl′ > Br′, I′. The results are best interpreted from the point of view of Bernal and Fowler's theory of hydration of ions (A., 1934, 13). All the cations studied, and among the anions only OH′ and F′, show const. hydration.
L. S. T.

Viscosity in the system $AsBr_3$–$PhNO_2$. I. L. KATZNELSON and A. V. BERNSCHTEIN (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 187—196).—The η–composition curves at 0°, 20°, 30°, 40°, and 50° suggest the occurrence of compounds $AsBr_3$,$PhNO_2$ and $AsBr_3$,$2PhNO_2$.   R. T.

Origin of colour in paramagnetic ions in solution. D. M. BOSE and P. C. MUKHERJI (Phil. Mag., 1938, [vii], 26, 757—776).—The available data on the absorption spectra of solutions containing paramagnetic ions (except the rare earths) are collected and an empirical formula is suggested to account for the no. and frequency of the principal bands, their fine structure being omitted. The paramagnetic ions form complexes with the dipole mols. of the solvent (if polar) and are acted on by an induced electric field in which the ground term of an ion of orbital moment L is split into $L + 1$ equidistant sub-levels having quantum nos. $e_L =$ 0, 1, 2 ... L. The absorption spectra are due to the transition from the lowest to higher levels and hence there are L absorption bands of frequency $\Delta\nu = Ne|\Delta e_L| . K_0/\epsilon$ where $\epsilon =$ dielectric const. $K_0 e/\epsilon$ is approx. const.   T. H. G.

Spectrophotometric study of neutralisation indicators. W. B. FORTUNE [with M. G. MELLON] (J. Amer. Chem. Soc., 1938, 60, 2607—2610).— Spectral transmittancy curves for several simple, modified, and mixed indicators at different p_H have been obtained.   E. S. H.

X-Ray investigation of the form of acetyl-salicylic acid in certain sugars. S. S. SIDHU (J. Appl. Physics, 1938, 9, 546—550).—X-Ray diffraction patterns of combinations of sucrose, glucose, and acetylsalicylic acid show only lines characteristic of the pure components and give no indication of complex formation or solid solutions.
J. A. K.

Systematic magnetic measurements on iron compounds, especially the course of the magnetic properties in the transition from bivalent to tervalent iron. O. GOTT and W. KRINGS (Z. anorg. Chem., 1938, 239, 345—364).—Magnetic properties in the systems FeO-Fe_2O_3-SiO_2 and FeO-Fe_2O_3-P_2O_5, and in Fe–borax glasses, have been studied, with a view to their possible use for determining the degree of oxidation of Fe in insol. compounds. Paramagnetism extends throughout the system Fe_2O_3-SiO_2 in the absence of Fe^{II} but does not follow the mixture law : there is a sharp max. of χ at 10% SiO_2. Even the slightest degree of oxidation of Fe_2SiO_4 or reduction of Fe_2O_3-SiO_2 preps. gives rise to ferromagnetic products, so that magnetic measurements give no information as to the degree of oxidation. In the systems Fe_2O_3-P_2O_5 and FeO-P_2O_5, χ increases linearly with [Fe] up to the compositions $FePO_4$ and $Fe_3(PO_4)_2$ and then decreases, in the Fe^{III} system to the val. for Fe_2O_3, and in the Fe^{II} system until the composition 63% FeO is attained, further increase in [Fe] then giving ferromagnetic products. By partial reduction of $FePO_4$ and preps. poorer in Fe, paramagnetic products are obtained, but there is no simple connexion between the % reduction and χ. Paramagnetic Fe–borax glasses containing both Fe^{II} and Fe^{III} can be obtained, but there is no simple connexion between χ and the degree of oxidation, and on tempering they all become ferromagnetic.
F. J. G.

Dissociation of mixed isomorphous crystal hydrates. K. P. VOLKOV (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 91—102).—The dissociation pressures, P, of mixed crystals of $MgSO_4$,$7H_2O$ and $ZnSO_4$,$7H_2O$ (10—90 mol.-%) at 16°, 20°, and 25° are < for the pure salts. The P-composition curves do not exhibit abrupt breaks, whence it is concluded that the crystals are physically homogeneous mixed crystals, and that double compounds are not formed. R. T.

Solubility of hydrogen in the iron lattice.— See B., 1938, 1426.

Solubility of hydrogen, deuterium, and nitrogen in iron. A. SIEVERTS, G. ZAPF, and H. MORITZ (Z. physikal. Chem., 1938, 183, 19—37).—Data are recorded for various Fe samples over a range 500—

1650°, and are compared with earlier data. The solubility of D_2 in any one Fe sample is $<$ that of H_2, the difference increasing with rise of temp.

C. R. H.

Solubility of hydrogen in tungsten–iron alloys. W. BAUKLOH and K. GEHLEN (Arch. Eisenhüttenw., 1938—9, **12**, 39—40).—At temp. up to 800° the solubility of H_2 in W–Fe alloys falls to a min. at 1·5% W, increases linearly up to 8·6% W, and finally decreases rapidly to 10·35% W, then more slowly. At 900° the min. at 1·5% W does not occur and at 1000—1050° there is no initial increase in H_2 solubility with increasing W content. These changes in H_2 solubility with variations in temp. and W content are correlated with the equilibrium diagram of the Fe–W system.

A. R. P.

Comparison of volume and [interatomic] distance contractions in intermetallic compounds. F. LAVES (Metallwirts., 1936, **15**, 631—639; Chem. Zentr., 1936, ii, 2674—2675).—Deviations from Biltz and Weibke's additive rule are considered (cf. A., 1935, 1199). The varying contraction of the Li atom in alloys with Zn, Cd, Al, Ga, and In is due to incomplete filling of the lattice spaces which the Li atoms occupy. The contractions of Mg, Cu, and Zn atoms are calc. from measured interat. distances in $MgNi_2$, $MgCu_2$, $MgZn_2$, and mixed crystals; the contractions for Zn and Mg are respectively $>$ and $<$ Biltz and Weibke's mean vals. for other alloys. Interat. distances in other AB_2-type structures are considered. Vals. of the mean at. radius in alloys, which are $<$ the normal at. radii, may be assigned to a no. of elements. A spatial interpretation of at. contractions is given.

A. J. E. W.

" Difference effect "of amalgams. P. Z. FISHER and T. E. KOVAL (Bull. Sci. Univ. Kiev, 1937, **3**, No. 3, 151—159).—Positive and negative "difference effects" were obtained with Na, K, and Zn amalgams in 0·1N- and 15% HCl. It is concluded that the effect cannot be connected with the formation of a protective film, and that none of the theories advanced adequately explains the phenomenon.

R. T.

Magnetic susceptibility of dilute sodium amalgams. S. ARAVAMUTHACHARI (Current Sci., 1938, **7**, 179—181).—The magnetic susceptibilities of 20 dil. Na amalgams ($<$1·3 wt.-% Na) have been determined by the Curie method. As the at.-% of the Na rises the diamagnetic susceptibility, χ, decreases slowly, then rapidly; it falls to a min. at approx. 4·5 at.-% Na, then increases slowly. The great deviation from the law of additivity may be due to (a) dissolution of the Na in the Hg, (b) formation of solid compounds in which the paramagnetic contribution of the free electrons in the atoms disappears and χ rises.

W. R. A.

Dependence of diffusion coefficients of metals on grain size. W. BUGAKOV and F. RIBALKO (Tech. Phys. U.S.S.R., 1935, **2**, 617—623; cf. Fonda et al., A., 1933, 771).—With varied temp. (T) and grain diameter (d), the diffusion coeff. (D_T) and heat of diffusion (Q) of Zn in brass have been determined by the evaporation method (B., 1937, 48). D_T increases with T and with decreasing d. For polycryst. metal

Q is const. (18,700 g.-cal.); a higher val. is claimed for single crystals. An interpretation in terms of the intergranular structure is supported by available evidence.

I. McA.

Theory of the transition of metallic mixed phases. V. Fluctuations and formation of nuclei in supercooled phases. G. BORELIUS (Ann. Physik, 1938, [v], **33**, 517—531; cf. A., 1937, I, 223).—The theory of concn. fluctuations in alloys with disordered at. arrangement is developed and is related to the previously derived equation for the variation with concn. of free energy. Wictorin's vals. for the time of half separation of Au–Pt alloys (cf. following abstract) agree with the theory.

O. D. S.

Separation of gold–platinum alloys. C. G. WICTORIN (Ann. Physik, 1938, [v], **33**, 509—516; cf. Johansson and Hagsten, A., 1937, I, 233).—The velocity of the separation on annealing at temp. in the two-phase region of Au–Pt alloys from 25 to 96 at.-% Pt has been followed by measurements of the electrical resistance. In a central region of concn. which broadens with decreasing annealing temp. separation is uninhibited. Limiting curves for the metastable state are calc. by the method of Borelius (loc. cit.) and agree with previous data.

O. D. S.

Silver–mercury complex. P. SPACU (Bul. Soc. Ştiinţe Cluj, 1936, **8**, 354—355; Chem. Zentr., 1936, ii, 2692).—The salt described by Wöhler (A., 1936, 1079) is considered to be $Ag[HgNO_3(CN)_2],2H_2O$, since when electrolysed it gives Ag at the cathode, and Hg and HCN at the anode. When treated with $o\text{-}C_6H_4Me\cdot NH_2$ (tol) in light petroleum it gives $[Ag\ tol_3][HgNO_3(CN)_2]$.

A. J. E. W.

Systems copper–germanium and silver–germanium. H. MAUCHER (Forschungsarb. Metallk. Röntgen-Metallogr., 1936, **20**, 22 pp.; Chem. Zentr., 1936, ii, 2438).—As-free Ge has been prepared by repeated distillation of $GeCl_4$ in HCl solution, followed by hydrolysis and reduction of GeO_2 with KCN + C. Corr. temp. and composition data for the Cu–Ge phase diagram are given. A compound Cu_3Ge, which melts without decomp., gives mixed crystals with melts of the peritectic composition, having a very narrow region of stability. The α- and β-phases have been studied with X-rays. Previous work on the system Ag–Ge is confirmed.

A. J. E. W.

Magnetic susceptibility of the [binary] systems of zinc with nickel, cobalt, and iron. J. SCHRAMM (Z. Metallk., 1938, **30**, 327—334).—Temp.–susceptibility curves of alloys in these systems show points of inflexion at temp. at which three-phase reactions or phase changes occur, and composition–susceptibility curves similar points at phase field boundaries. In the Ni–Zn system these boundaries are $\delta/\delta + \eta$ at 10% Ni up to 400°, $\Gamma/\Gamma + \Gamma_1$, at 20% Ni, $\beta_1/\beta_1 + \Gamma_1$ at 45·5% Ni up to 675°, $\beta_1/\alpha + \beta_1$ at 52% Ni up to 750°, and $\beta/\alpha + \beta$ at 50% Ni above 850°; in the Fe–Zn system they are $\delta_1/\zeta + \delta_1$ at 7% Fe up to 530°, $\delta_1/\Gamma + \delta_1$ at 11·5% Fe up to 600°, and $\Gamma/\alpha + \Gamma$ at 28% Fe up to 700°. The various temp. horizontals determined by this method confirm those previously found by thermal analysis.

A. R. P.

Diffraction of *X*-rays by an age-hardening alloy of aluminium and copper. Structure of an intermediate phase. G. D. PRESTON (Phil. Mag., 1938, [vii], **26**, 855—871; cf. A., 1938, I, 611).— Attempts have been made to estimate the dimensions of the regions into which the Cu segregates in an alloy containing 4 or 5% Cu during age-hardening at room temp. and at 200°. The regions appear to consist of $\ngtr$ five (100) planes of Cu atoms with $\ngtr$ 100 atoms per layer at room temp. Heat-treatment of crystals previously age-hardened at room temp. suggests that the Cu atoms first redissolve and later reappear as similar sheets of larger area. The thickness gradually increases and finally a new phase appears. This phase is of the CaF_2 type but is tetragonal and has 4 Cu and 8 Al per cell. Its structure differs from that of the $CuAl_2$ usually obtained, and whether it is a metastable intermediate phase or the form of $CuAl_2$ stable at low temp. is not clear.
                                             T. H. G.

Irregular dilatometric anomalies in aluminium–copper alloys.—See B., 1938, 1432.

Crystal structure of intermetallic compounds of aluminium with titanium, zirconium, thorium, niobium, and tantalum. G. BRAUER (Naturwiss., 1938, **26**, 710).—In the binary systems of Al with Ti, Zr, Th, Nb, and Ta the intermediate type of crystal richest in Al possesses in each case the formula MAl_3. The tetragonal cryst. structure of $TiAl_3$ obtained by Fink *et al.* was confirmed. $NbAl_3$ and $TaAl_3$ also crystallise in the tetragonal system. Lattice consts. for $TiAl_3$, $NbAl_3$, and $TaAl_3$ are a 5·425, 5·427, 5·422; c 8·579, 8·584, and 8·536 A., respectively. $ZrAl_3$ is tetragonal, a 4·00, c 17·3 A., 16 atoms in cell. $ThAl_3$ is hexagonal, a 6·480, c 4·601 A., 8 atoms in cell.   A. J. M.

Solubility of chromium in aluminium. W. KOCH and H. WINTERHAGER (Metallwirts., 1938, **17**, 1159—1163).—Dilatometric, resistivity, and *X*-ray methods were employed. The solid solubility is 0·87% Cr at 660° and ∼ 0·05% Cr at 300°.
                                             C. E. H.

System manganese–aluminium. W. KÖSTER and W. BECHTHOLD (Z. Metallk., 1938, **30**, 294— 296).—The system was re-examined by thermal and magnetic analysis and by micrographic examination. On adding Al to Mn the m.p. rises to a max. at 1287°, 15% Al; further addition of Al produces a peritectic reaction at 1160° resulting in the formation of MnAl, and a second similar reaction at 995° with the formation of $MnAl_3$. The first horizontal extends from 63 to 72·5% Mn and the second from 38 to 49% Mn. MnAl dissolves up to 18% Al but no Mn; between 41 and 49% Mn the alloys consist of $MnAl_3$+ MnAl saturated with Al. The δ-field extends to 72·5% Mn at 1160° and to 82% Mn at 1005°; at the latter point there is a eutectoidal transformation into γ-Mn+MnAl. The δ–γ transformation point of Mn is lowered progressively to 1005° with 14% Al and the γ–β to 930° with 13% Al; both transformations occur in all alloys with >67% Mn. The β–α transformation is lowered to room temp. with >5% Al.   A. R. P.

System manganese–vanadium.—See B., 1938, 1435.

System iron–iron silicide (FeSi)–graphite. H. JASS and H. HANEMANN (Giesserei, 1938, **25**, 293—299).—Thermal and micrographic investigations were carried out on alloys containing up to C 4·24 and Si 22·3%, and an equilibrium diagram is given. In the graphite system, the binary eutectic curves studied run from 4·23% C at 1152° on the C side to 21·2% Si at 1205° on the Si side. The eutectic C content is approx. 4·23 − (Si%÷3·2). Two transformation surfaces involving the liquid have been found at 1172° and 1200°. In the course of the binary eutectic curves the eutectoid change appears up to 8% Si, primary and eutectic grains only are seen above 10% Si, and the ε- and δ-phases appear at 16% Si. Above 20% Si all C is in solution. Dendrites are always seen in specimens of eutectic C content, indicating a strong tendency to undercooling. Si reduces the size of the eutectic graphite particles.
                                             C. E. H.

Equilibrium diagram iron–niobium. H. EGGERS and W. PETER (Mitt. Kaiser-Wilh.-Inst. Eisenforsch., 1938, **20**, 199—203).—The system has been studied by means of cooling curves, photomicrography, and *X*-rays, and the equilibrium diagram constructed up to 70% Nb. There are two *compounds*, Fe_3Nb_2 (I), m.p. 1650—1660°, and another (II) richer in Nb, the composition of which was not determined. The eutectics are at 1356° with 17·5—18% Nb and 1560° with 67—67·5% Nb. (I) takes up a considerable % of Fe, but very little Nb, into solid solution. δ-Fe dissolves up to 12% of Nb at 1356°, but α- and γ-Fe take up much smaller amounts and there is a eutectoid at 1220° and 10% Nb, where the δ-phase decomposes into γ and (I) saturated with Fe. (I) and (II) are both stable down to room temp. The systems Fe–Nb, Fe–V, Fe–Ta, Fe–Zr, and Fe–Mo are compared.
                                             F. J. G.

Two-component system iron–rhenium. H. EGGERS (Mitt. Kaiser-Wilh.-Inst. Eisenforsch., 1938, **20**, 147—152).—The system has been studied up to 70% Re by means of cooling curves, photomicrography, and *X*-rays, and an equilibrium diagram constructed. There are five homogeneous phases, α, γ, δ, and η mixed crystals, and a *compound* Fe_3Re_2 which is stable over the whole temp. range. α-, γ-, and δ-Fe take up considerable amounts of Re in solid solution, *e.g.*, 29% at room temp., 40% at 1205°, and 7% at 1540°; the η-mixed crystals are deposited from melts with >15% of Re, and the region of stability extends down to a eutectoid at 1205°, composition approx. Fe_3Re, where γ and Fe_3Re_2 are deposited. The systems Fe–Re, Fe–Os, and Fe–W are compared.   F. J. G.

Systems of cobalt with boron, arsenic, zirconium, niobium, and tantalum. W. KÖSTER and W. MULFINGER (Z. Metallk., 1938, **30**, 348— 350).—All these systems contain a binary compound which forms a eutectic with Co. Co_2B, m.p. 1265°, is ferromagnetic, Co_4Zr has a very high m.p., Co_5Nb_2 melts at 1500°, and Co_5Ta_2 at 1550°. The eutectic points are: Co–B 1102°, 5·5% B; Co–As 920°,

30% As; Co–Zr 1460°, 12% Zr; Co–Nb 1235°, 21% Nb; Co–Ta, 1275°, 31% Ta. The saturated Co-rich solid solutions contain : 1% B (20—1100°); 5% As at 20° and 7% at 900°; 2% Zr up to 1200°; 4% Nb at 20° and ~8% above 1200°; 8·5% Ta at <1000° and 13% at 1275°. Alloys with 4—8% Nb and 8—13% Ta can be pptn.-hardened.   A. R. P.

Mg–MgCd₂–Mg₅Tl₂ portion of the ternary magnesium–cadmium–thallium system. W. KÖSTER and E. WAGNER (Z. Metallk., 1938, **30**, 335—338).—Replacement of Tl in Mg–Tl alloys by increasing amounts of Cd narrows the solidification range and extends the range of homogeneous ε solid solution. There is a four-phase reaction at 320° : liquid+ ε (Mg 40, Cd 45, Tl 15%) = MgCd₂+Mg₅Tl₂. A small amount of pptn.-hardening can be obtained with an alloy of Mg 30, Cd 35, Tl 35%, but the alloy is very susceptible to corrosion by air and tap-water, as are most of the alloys with a low proportion of Mg.   A. R. P.

Mg–Al₃Mg₄–Mg₅Tl₂ portion of the ternary magnesium–aluminium–thallium system. W. KÖSTER and E. WAGNER (Z. Metallk., 1938, **30**, 338—342).—Al₃Mg₄ and Mg₅Tl₂ from a quasi-binary simple eutectiferous system with a eutectic at 398°, Mg 28, Al 7, Tl 65%; the solid solubility range at this temp. extends at the Al₃Mg₄ end to Mg 51, Al 40, Tl 9% and at Mg₅Tl₂ end to Mg 24, Al 1, Tl 75%. In the pseudoternary system Mg–Al₃Mg₄–Mg₅Tl the ternary eutectic is at 395°, Mg 32·5, Al 5, Tl 62·5%; the solid compounds consist of ε (Mg 52, Al 5, Tl 43%), θ (Mg 51·5, Al 39·5, Tl 9%), and almost pure Mg₅Tl₂. The ε-Mg-rich solid solution extends over a wider range at the eutectic temp. than at room temp. and hence these alloys can be pptn.-hardened; thus the alloy with Mg 72, Al 8, Tl 20% shows an increase in tensile strength and hardness of 80—100% after quenching from 400° and reheating at 200° for 2 hr. The alloys, however, have a very poor resistance to corrosion in moist air.   A. R. P.

System aluminium–iron–magnesium. M. BARNICK and H. HANEMANN (Aluminium, 1938, **20**, 533—535).—The Al corner of the equilibrium diagram of the system Al–Fe–Mg has been studied by microscopic, thermal, and X-ray methods. The only solid phases occurring are solid solutions in Al (α-phase), Al₃Fe, and Al₃Mg₂ (β-phase). These form a ternary eutectic at 445° with Al 68%, Fe 3%, and Mg 29%. The corresponding α-phase contains 13·3% of Mg and very little Fe.   J. W. S.

Iron corner of the iron–titanium–carbon system. W. TOFAUTE and A. BÜTTINGHAUS (Arch. Eisenhüttenw., 1938—9, **12**, 33—37).—Addition of C to Ti–Fe alloys enlarges the γ-field from 0·8% Ti to 1% Ti with 0·35% C; with more C this field steadily becomes smaller, hence the α–γ transformation of Fe–C alloys is displaced to higher C content and higher temp. by addition of Ti so that low-C alloys with 3% Ti are always ferritic. The ternary alloys can be age-hardened provided that sufficient Ti (4—22%) is present in solid solution; TiC takes no part in this action. Alloys which remain ferritic up to the m.p. cannot be hardened by quenching. TiC and Fe₃C

appear to have no mutual solubility but form a pseudobinary eutectiferous system, as also do Fe₃Ti and TiC. In the ternary system there are four points of four-phase equilibrium : (a) at 1340° between liquid (Ti 10, C 1·65%), α (Ti 5·5, C 0·2%), Fe₃Ti, and TiC; (b) at 1320° between liquid (Ti 1·6, C 2%), α (Ti 1·27, C 0·07%), γ (Ti 1·0, C 0·1%), and TiC; (c) at 1140° between liquid (Ti 0·8, C 3·9%), γ (Ti 0·22, C 1·61%), TiC, and Fe₃C; and (d) at 740° between α (Ti 0·18, C 0·05%), γ (Ti 0·1, C 0·72%), TiC, and Fe₃C.   A. R. P.

System nitrogen–steel. L. PALATNIK (Tech. Phys. U.S.S.R., 1935, **2**, 598—616).—An analysis (mainly X-ray) of Cr–Mn–Si steels nitrided in NH₃ at 500—650° is compared with the extensively reviewed results of the substantially similar Fe–N system. An important factor is the stability of the metal component nitrides, which varies in periodic column order. The disputed ζ-phase occurs, probably a metastable form of Fe₂N in the Fe–N system. Cubic (and tetragonal ?) nitrided martensite occurs in a Cr–Mo–Al steel. Decomp. of the ε-phase by diffusion is discussed in relation to the finely-dispersed γ′-phase. The α-phase (solid solution of at. N) is an infusion type; mechanisms and structure are discussed.   I. McA.

Iron corner of the equilibrium diagram iron–niobium–carbon below 1050°. H. EGGERS and W. PETER (Mitt. Kaiser-Wilh.-Inst. Eisenforsch., 1938, **20**, 205—211).—Nb–C steels contain a *Nb carbide*, Nb₄C₃, which is cubic with a 4·46 A. There are no double Fe–Nb carbides. Fe–Nb–C alloys having up to 2% Nb and 2·4% C have been studied by means of cooling curves and photomicrography. There are two four-phase planes corresponding with the reactions γ ⇌ α + Nb₄C₃ + Fe₃C at 705° and γ + Fe₃Nb₂ ⇌ α + Nb₄C₃ at 920°.   F. J. G.

Cobalt corner of the iron–cobalt–vanadium system. W. KÖSTER and K. LANG (Z. Metallk., 1938, **30**, 350—352).—Alloys of Co with 5 : 95 Fe–V form a eutectic at 42% V, 1150°, the two constituents being γ-Co solid solution and an intermediate phase θ. The γ-phase extends to 31% V and the γ + θ field from 31 to 48% V. Addition of V to Co increases the hysteresis of the γ–ε transformation, which reaches 680° at 15% V, and depresses the magnetic transformation point of Co progressively to room temp. at ~26% V. With an increasing Fe–V ratio the γ-range is considerably extended whilst the γ + θ field becomes narrower and eventually disappears with a 4 : 1 Fe–V ratio; with this Fe–V ratio alloys with 35—65% Co consist entirely of α at room temp. and entirely of γ at above 800—850°.   A. R. P.

Ternary system cobalt–manganese–copper. W. KÖSTER and E. WAGNER (Z. Metallk., 1938, **30**, 352—353).—The miscibility gap in the Co–Cu system is hardly affected by addition of up to 40% Mn, so that homogeneous alloys, which can be pptn.-hardened and thus given useful ferromagnetic properties, cannot be obtained in this system.   A. R. P.

System cobalt–manganese–aluminium. W. KÖSTER and E. GEBHARDT (Z. Metallk., 1938, **30**, 281—286).—The equilibria in the system between the Co–Mn and the CoAl–MnAl lines of the ternary

diagram were established by thermal and magnetic analysis and by micrographic examination. CoAl and MnAl form a continuous series of solid solutions and the alloys are ferromagnetic over a wide range of composition. CoAl and Mn form a pseudobinary system with a peritectic reaction at 1245°, the liquid containing Co 23, Al 11, and Mn 66%; the β-Mn solid solution extends to 22% CoAl and the α-CoAl solid solution to 17% Mn at 20°, 20% at 800°, and 69% Mn at >1050° so that alloys with >20% Mn can be pptn.-hardened by suitable heat-treatment. In the ternary system there are four-phase reactions at 1170° (liquid + δ_{Mn} = α + γ_{Mn}), 1160° (liquid + γ_{Mn} = α + γ), and 1030° (γ_{Mn} = α + γ + β_{Mn}). Equilibrium diagrams are given for alloys with const. Mn contents of 10, 30, and 50%, for const. Al contents of 5, 15, and 25%, and for the CoAl–Mn system. A. R. P.

Magnetic properties of cobalt–manganese–aluminium alloys. W. KÖSTER and E. GEBHARDT (Z. Metallk., 1938, **30**, 286—290).—The highest magnetic saturation (7500 gauss) is shown by homogeneous alloys consisting of CoAl saturated with Co; addition of Al or Mn reduces the saturation progressively to 3800 gauss. In homogeneous α-alloys with an ordered at. structure the Curie temp. falls almost linearly with increasing quenching temp., but in alloys of the system CoAl–Mn the Curie temp. and magnetisation rise with increasing quenching temp. owing to the increased solubility of Mn at high temp.; reheating of the latter alloys to produce pptn. of β-Mn considerably reduces the magnetisation since both the pptd. phase and the remaining solid solution are only slightly magnetic. With alloys in the α + γ range good magnetic properties are obtained by quenching from 1300° and reheating for 30 min. at 650°; after this treatment the alloy with Co 79, Mn 10, Al 11% has a coercivity of 300 oersted with a remanence of 7000 gauss, vals. which are about 60 times as great as those shown by the quenched alloy. The mechanism of the pptn. processes in these two types of alloys is discussed. A. R. P.

System nickel–manganese–aluminium. W. KÖSTER and E. GEBHARDT (Z. Metallk., 1938, **30**, 291—293).—The equilibria in this system resemble closely those in the corresponding Co system. NiAl and Mn form a quasi-binary system with a min. m.p. of 1120° at 66% Mn and a wide α-range extending to 80% Mn at 1050° and 23% at 20°; alloys quenched from above the solubility line are all ferromagnetic. There is a peritectic reaction at 1170° in liquid containing Mn 78, Ni 15, Al 7% due to the separation of γ-Mn. The solidification of alloys in the ternary system is controlled by the broad range of homogeneous α solid solution at high temp.; the equilibria in this system are shown in diagrams for const. Mn contents of 20 and 40% and for const. Al contents of 10 and 15%. A. R. P.

Solutions and solubility. A. E. VAN ARKEL (Chem. Weekblad, 1938, **35**, 768—771).—A general discussion of some of the factors involved in solubility, including heat of mixing, van der Waals–London forces, and in the case of electrolytes the electrical properties. S. C.

Theory of miscibility. A. J. STAVERMAN (Chem. Weekblad, 1938, **35**, 772—776).—The theory of miscibility is discussed mathematically, particularly from the point of view of the significance of London, Debye, and Keesom energies. Positive heats of mixing are explained by a new definition of Keesom energy, and from a consideration of the entropies of normal and abnormal liquids suggestions are made for predicting energies, v.p., partition coeffs., etc. S. C.

Solubility of carbon dioxide in deuterium oxide at 25°. J. CURRY and C. L. HAZELTON (J. Amer. Chem. Soc., 1938, **60**, 2771—2773).—The mol. solubility in D_2O is 0·902 of that in H_2O. E. S. H.

Hydrogen bonds involving the C–H link. IV. Effect of solvent association on solubility. V. Solubility of methylene chloride in donor solvents. M. J. COPLEY, G. F. ZELLHOEFER, and C. S. MARVEL (J. Amer. Chem. Soc., 1938, **60**, 2666—2673, 2714—2716; cf. A., 1938, 1, 394).—IV. The solubility of $CHCl_2F$ in PhOH, 2 glycols, 6 ethers, 2 acids, 6 esters, 7 amines, 9 amides, 10 CO-compounds, and CMeEt:N·OH is measured. The observed results are accounted for as follows, if high solubility is due to formation of C·H←O and C·H←N linkings. Alcohols form linear polymerides, the H←O linking being too strong to be broken. Ethers, esters, NN-di-substituted amides, ketones, and aldehydes do not polymerise and are good solvents. Acids and CMeEt:N·OH, giving cyclic dimerides, are rather poor solvents, and similarly diketones which chelate internally are not such good solvents as those which do not. Amides are poor solvents, although not poor enough to necessitate consideration of linear polymerides; a probable mode of polymerisation is suggested. Unsaturation may sometimes cause association. Ph decreases the donor power of N or O.

V. The solubility of CH_2Cl_2 in 35 solvents is explained on the basis of C·H←O and C·H←N linkings, as with $CHHal_3$. R. S. C.

Aqueous solubilities of isomeric heptanols. P. M. GINNINGS and M. HAUSER (J. Amer. Chem. Soc., 1938, **60**, 2581—2582).—Data are recorded for βγγ-trimethylbutan-β-ol at 40° and βγ-, ββ-, and βδ-dimethylpentan-γ-ol, βγ- and βδ-dimethylpentan-β-ol, γ-methylhexan-γ-ol, β-methylhexan-β-ol, and γ-ethylpentan-γ-ol at 20°, 25°, and 30°. The seven *tert.* isomerides are more sol. than the two most compact *sec.* isomerides. Max. solubility occurs when the OH is as close as possible to the centre of a compact *tert.* mol. The solubility of the isomerides decreases with rising temp. from 20° to 30°. E. S. H.

Influence of the method of preparation and physical structure of silver chloride on its solubility. A. PINKUS and P. HANREZ (Bull. Soc. chim. Belg., 1938, **47**, 532—574).—Potentiometric measurements indicate that, with the exception of colloidal suspensions, the solubility of AgCl is independent of its method of prep. and of its physical structure. The almost insol. granular form of Stas could not be obtained. The ionic solubility of all samples at 25° and in 0·1N-KNO_3 is $1·58 \times 10^{-5}$ g.-mol. per l. Very fine colloidal suspensions show a solubility about 5% > this val. J. W. S.

Solubility of sodium borates in saturated solutions of sodium chloride in the presence of magnesium sulphate. N. A. SCHLESINGER, I. B. FEIGELSON, and A. I. SPIRIAGINA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 141—143).—The solubility of $Na_2B_4O_7,10H_2O$ in saturated NaCl solutions at 35° is $\ll$ in pure H_2O. It increases in the presence of increasing proportions of $MgSO_4$ and eventually exceeds the solubility in pure H_2O. Its solubility in pure dil. $MgSO_4$ at 35° is $<$ in pure H_2O but decreases further with increasing concn. of $MgSO_4$. At 50° $Na_2B_4O_7$ exists in pure H_2O as the penta-hydrate but in solutions of NaCl or $MgSO_4$ at 50° passes into the decahydrate again. As before, the solubility in saturated NaCl increases with increasing [$MgSO_4$]. T. H. G.

Calcium sulphate in sea-water. II. Solubilities of calcium sulphate hemihydrate in sea-water at various concentrations at 60—150°. T. TORIUMI, T. KUWAHARA, and R. HARA (Tech. Rep. Tôhoku, 1938, **12**, 560—571).—See A., 1934, 139. J. W. S.

Arsenophosphoric and arsenoarsenic acids. Solubility of monomeric arsenious anhydride in monobasic phosphates and arsenates. D. GHIRON and M. MONTICELLI (Gazzetta, 1938, **68**, 555—559; cf. A., 1936, 560).—The solubility of As_2O_3 in aq. solutions of NaH_2PO_4, KH_2PO_4, NaH_2AsO_4, and KH_2AsO_4 (Na salts 1·0 and 5·0M., K salts 1·0M.) has been determined at 25°, 60°, and 100°. The solubility is $>$ in the corresponding acid of the same concn. This is taken to indicate the existence of arseno-phosphoric and -arsenic acids. O. J. W.

Diffusion of hydrogen through metals.—See B., 1938, 1436.

Partition of sulphur dioxide between water and light petroleum. A. SCHAAFSMA (Chem. Weekblad, 1938, **35**, 821—823).—The partition coeff. of undissociated SO_2 mols. between H_2O and petroleum is const. at concns. of 0·027—0·5%. The solubility of SO_2 in petrol depends on the aromatic hydrocarbon content and is much greater in C_6H_6 than in aromatic-free spirit of the same b.p. The reduced partition coeff. has a high negative temp. coeff. in non-aromatic hydrocarbons and is nearly const. in aromatic spirits (C_6H_6). The theoretical aspect is also discussed. S. C.

Absorption of gases by tantalum. D. A. WRIGHT (Nature, 1938, **142**, 794).—The absorption of H_2 and N_2 by Ta at different temp. and low pressures (" clean-up ") is described. Absorption is modified by the presence of surface oxide, and the variations shown in earlier work are due to this cause. L. S. T.

Conventions and assumptions in the interpretation of experimental data by means of the Gibbs adsorption theorem. P. VAN RYSSELBERGHE (J. Physical Chem., 1938, **42**, 1021—1029).—Theoretical. The interpretation of surface tension (γ) data for binary mixtures is discussed, and the simplest possible mixture rule is considered in reference to data for the γ of $EtOH$–H_2O mixtures. C. R. H.

Relative adsorbabilities of hydrogen and deuterium. A. WHEELER (J. Chem. Physics, 1938, **6**, 746—748).—A statistical-mechanical treatment of the relative adsorbabilities of H_2 and D_2 on metal surfaces, in terms of partition functions for the adsorbed mols. and atoms, predicts equal adsorption at low temp. and an inversion temp. at higher temp.; these are in agreement with the experimental data of Beebe *et al.* (cf. A., 1936, I, 282) and Klar (cf. A., 1935, 27) for Cu and Ni, respectively. W. R. A.

Sorption of chlorine by active charcoal. III. Rate of sorption. K. ARII (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 717—738; cf. A., 1937, I, 129).—The rate of sorption of Cl_2 by sugar-C activated by heating at 900° for 2 hr. has been determined at 20°, 30°, and 40°, and at const. pressures of 200, 400, and 600 mm. The results agree with the equation $x = At^B$ (x = mg. sorbed by 1 g. of C in time t; A and B, consts.). An equation for sorption velocity at const. pressure, and another for const. temp., are derived. The fact that it takes 65 days for sorption equilibrium to be reached at const. pressure, but that 8·5—23% of the equilibrium val. is sorbed in 1 min., indicates that the sorption of a gas by a porous adsorbent consists of a primary adsorption followed by absorption. A. J. M.

Binary systems. I. Adsorption from binary mixtures of toluene and acetic acid by charcoal and silica gel. J. G. KANE and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 331—344).—The adsorption of AcOH and of PhMe from their mixtures on SiO_2 gel, sugar C, and animal C has been investigated. AcOH is preferentially adsorbed on SiO_2 gel, and PhMe on C, from all mixtures. Animal C adsorbs PhMe preferentially from mixtures containing $>60\%$ of AcOH, but AcOH from less conc. mixtures. This behaviour is attributed to the presence of ash in the C. The curves show either zero selective adsorption, or else a min. or a max., at compositions corresponding with compounds of AcOH and PhMe in the proportions 2 : 1, 4 : 1, 6 : 1, and 8 : 1. F. J. G.

Chemisorption on charcoal. XII. The isoelectric point. H. L. BENNISTER and A. KING (J.C.S., 1938, 1888—1891).—The cataphoretic velocities of charcoals activated at various temp. and suspended in acid or alkaline solutions have been studied. All the specimens examined were negatively charged at p_H $>4·0$, and isoelectric between p_H 3·0 and p_H 4·0; there are indications of a second isoelectric point at p_H 1—1·5. At p_H $>4·0$ the effect of the temp. of activation was marked, specimens activated at 850° having the max. negative velocity. F. J. G.

Electric double layer, an effective potential barrier for the accumulation of the solute at surfaces of solutions of capillary-active electrolytes. K. S. G. DOSS (Current Sci., 1938, **7**, 182).—The electric double layer, formed on the solution side of the interface between an aq. solution of a capillary-active electrolyte and the adsorption film produced on its surface by ageing, presents an effective potential barrier for the further accumulation of the capillary-

active ions, especially when the adsorption film is of the gaseous type. W. R. A.

Adsorption of electrolytes from non-aqueous solutions. D. M. STRASHESKO (Bull. Sci. Univ. Kiev, 1937, **3**, No. 3, 197—220).—Active C adsorbs salts of heavy metals ($CoCl_2$, $CuCl_2$, $HgCl_2$), but not KI or NH_4CNS, from $COMe_2$ solution. Adsorption of salts is inversely $\propto$ their degree of dissociation in $COMe_2$, but is not related to their solubility. R. T.

Adsorption at crystal-solution interfaces. X. Adsorption of monoazo-dyes by crystals of potassium sulphate during their growth from solution. M. D. RIGTERINK and W. G. FRANCE (J. Physical Chem., 1938, **42**, 1079—1088).—Dye adsorption depends on the residual valency force fields of the crystal faces, the interionic distances between the faces, the concn. of the dye, and the presence and distribution of polar groups in the dye mol. The mode of attachment of the dye mol. is probably through the O triangle possessed by the SO_3Na group, the most active positions being m and p to the ·N:N· group in the C_6H_6 ring, and in the 6- and 7-positions in the $C_{10}H_8$ ring. The presence of an unsubstituted C_6H_6 ring is detrimental to adsorption. Dyes produced from β- are more adsorbed than those from α-naphtholsulphonic acids, but the reverse is the case if NH_2 is substituted for OH, suggesting that the dipole moment of the dye must be considered in the adsorption process. Twinning appears to be caused by the adsorption of a minute amount of impurity at some point favourable to the growth of a new crystal. C. R. H.

Adsorption of constituents of a solid phase on the surface. S. DOBIŃSKI (Bull. Acad. Polonaise, 1938, A, 169—178).—Previous explanations of the production of surface layers (e.g., of pure ZnO in the high-temp. oxidation of brass) are based chiefly on chemical arguments which assume that before oxidation the concn. of the constituents of the brass on the surface is the same as in bulk. Experiments indicate that diffusion can occur under suitable conditions, causing a concn. of one constituent in the surface layer. This can be effected in Cu containing 0·01% of S by (i) heating in vac. at 800° for 4 hr., (ii) subjecting the specimen to alternating stresses, and (iii) polishing the surface. By comparison with adsorption of constituents of a liquid phase, the solid with the smallest surface tension should concentrate in the surface layer. This is approx. confirmed for brass, Cu–Be and Cu–Al alloys. W. R. A.

Statistical mechanics of mobile monolayers. W. BAND (J. Chem. Physics, 1938, **6**, 748; cf. A., 1938, 1, 603).—The methods of Mayer and Ackermann (cf. ibid., 1937, **3**, 74) have been adapted to the problem of mobile monolayers. A relation between the saturated vapour tension F_c and the crit. area A_c for a monolayer of mols. is deduced, and yields information on the fatty acids in agreement with recorded data. W. R. A.

Boundary layer at membrane and monolayer interfaces. J. H. SCHULMAN and T. TEORELL (Trans. Faraday Soc., 1938, **34**, 1337—1342).— Technique for flowing monolayers over aq. solutions of different viscosities is described. An apparent boundary layer about 0·03 mm. thick was observed, the thickness of which varied with the η of the underlying solution but not with the velocity of the monolayer. It is suggested that the mol. density of the film changes with velocity so that the no. of mols. per unit area × rate of flow = const. By applying Fick's equation to H· diffusing through Cellophane membranes in a stirred solution, an apparent unstirred boundary layer of 0·03 mm. was obtained. The effect of this layer can be eliminated by buffering the H· by means of gelatin as they leave the membrane. E. S. H.

Structure of the surfaces of solutions as shown by their resistance to the spreading of insoluble films. T. F. FORD and D. A. WILSON (J. Physical Chem., 1938, **42**, 1051—1061).—After a very short time the rate of spreading of oleic acid films on H_2O is const., therefore the changes in rate observed with solutions must be due to the presence of solute films. From experiments with solutions of $Ph·[CH_2]_2·CO_2H$, $C_7H_{15}·CO_2H$, and PhOH it has been shown that films of solute mols. exist on the surface of aged solutions, but that immediately after sweeping the solution surface with paper strips, the surface resembles that of H_2O. The analogy between these films and two-dimensional insol. films has been demonstrated. C. R. H.

Built-up films of esters. E. STENHAGEN (Trans. Faraday Soc., 1938, **34**, 1328—1337).—The type of deposition is nearly independent of the substrate, but depends on the piston pressure. At normal rates of withdrawal, Y-deposition generally occurs with an oleic acid piston, and X-deposition is always obtained with a triolein piston. At low piston pressures, slow withdrawal enables the film to return to the H_2O surface, medium speed permits X-deposition, and Y-deposition is obtained at high speed. Optical measurements of the thickness of the layers and X-ray measurements of the long spacing in the built-up films have been made in the case of Me and Et stearate, octadecyl acetate, trimyristin, and αα'- and αβ-dipalmitin. Preliminary work on the contact potentials of ester films shows that they are complicated functions of the constitution of the film substance, of the composition of the substrate, and treatment of the film. E. S. H.

Properties of chlorophyll multifilms. M. F. E. NICOLAI and C. WEURMAN (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 904—908).—Modified technique for building up the films is described. Differences between the uptake of " A " and " B " layers, and the influence of the substrate on which the films are deposited, are discussed. E. S. H.

Expansion patterns of protein monolayers on water. V. J. SCHAEFER (J. Physical Chem., 1938, **42**, 1089—1098).—A simple technique for rendering protein monolayers visible is described. The effect of heating, ultra-violet radiation, shaking, dissolved salts, and p_H on the nature of expansion patterns has been investigated. C. R. H.

Salted-out protein films. I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1938, **60**, 2803—2810).—Compact films of protein (200—1000 A.) are salted-out on to metal or glass plates when the plate is dipped into a protein solution and then into aq. NaCl, $(NH_4)_2SO_4$, etc. The film can be washed with H_2O without loss after fixing by 1% tannic acid. Protein films (up to 7000 A.) are formed on the surface of salt solutions by applying a few drops of the protein solution. Such films can be deposited on to plates and transferred to H_2O surfaces, where the amount of protein can be determined from the area of the monolayer produced. Dried, salted-out films of cryst. egg-albumin have n 1·48; the low val. and the power to absorb hydrocarbon vapours indicate a skeletal structure. E. S. H.

Boundary tension by pendant drops. J. M. ANDREAS, E. A. HAUSER, and W. B. TUCKER (J. Physical Chem., 1938, **42**, 1001—1019).—The mathematical theory of the shape of static liquid drops is revised, and an apparatus is described whereby the silhouette of a hanging drop can be photographed and the boundary tension calc. from the dimensions of the silhouette. The method is applicable to a wide range of tensions and both surface and interfacial tension can be measured. Other advantages are enumerated and typical measurements are presented. C. R. H.

Lowering of surface tension of water by electrolytes. J. J. BIKERMAN (Trans. Faraday Soc., 1938, **34**, 1268—1274).—Theoretical. The work associated with increase of surface of solution consists in (1) bringing H_2O mols. on to the surface (this is independent of concn.), (2) compressing the ions into a smaller vol. (increases with increasing concn.), and (3) separating positive and negative charges under the surface (this decreases with increasing concn.). The combined effect produces a surface tension–concn. curve which agrees with experimental data (A., 1937, I, 126). E. S. H.

Surface tension of soap solutions.—See B., 1938, 1447.

Ultrasonic waves in colloid chemistry. K. SÖLLNER (J. Physical Chem., 1938, **42**, 1071—1078).— A short account is given of the author's published work (cf. A., 1935, 820 and subsequently). C. R. H.

Study of colloidal solutions by combined measurements of viscosity and optical density. A. BOUTARIC (Compt. rend., 1938, **207**, 802—804).— Combination of the Rayleigh formula for the optical density (h) with the Einstein η relation leads to the relationship $(1/h) \log_e (\eta/\eta_0) = aN/bm$ (N, m = no. and mass of dispersed particles per unit vol.; a, b, consts.). A. J. E. W.

Green gold sols. H. B. FRIEDMAN and J. J. DAVIS, jun. (J. Physical Chem., 1938, **42**, 1149—1150).—Au sols, prepared by reducing $AuCl_3$ with tannic acid (I), are red or green according to whether the solution of (I) is fresh or old. C. R. H.

Colloidal clays. I. E. A. HAUSER and D. S. LE BEAU (J. Physical Chem., 1938, **42**, 1031—1049). —The apparent sp. gr. and abs. viscosity of mono-

disperse montmorillonite fractions of extremely low concns. increase with decreasing particle size and increasing concn. The sp. gr. data show that H_2O must be strongly adsorbed and compressed on to the clay particles. C. R. H.

Thorium hydroxide sols as opaque media in roentgenography. T. O. MENEES and J. D. MILLER (Amer. J. Roentgenol., 1936, **35**, 194—199).—$Th(OH)_4$ forms stable sols, but is coagulated in an alkaline medium. Coagulation occurs readily in an organ with an alkaline secretion, especially in the presence of mucus, such as is found in the uterus. Coagulation occurs on the inner surface of the organ, rendering it highly opaque to X-rays. CH. ABS. (e)

Ferromagnetic ferric oxide aërosols and hydrosols. A. WINKEL and R. HAUL (Z. Elektrochem., 1938, **44**, 823—831).—The prep. of γ-Fe_2O_3 aërosols by thermal decomp. of $Fe(CO)_5$ in a stream of $N_2 + O_2$ is described. In certain cases aggregation into chains of particles occurs. The product of decomp. at 900° gives an X-ray diagram with sharp interference lines, but as the temp. of decomp. is lowered the product appears to be more amorphous; the product of decomp. at 200° is paramagnetic. The sediment of the aërosol has a high sp. surface; it is peptised by H_2O, forming electrolyte-free hydrosols. The particle size, charge, and stability of such hydrosols have been studied. E. S. H.

Viscosity of semi-colloidal solutions of starch hydrolysis products. K. P. VOLKOV and A. M. ALMAZOV (Bull. Sci. Univ. Kiev, 1937, **3**, No. 3, 121—138).—Einstein's and Arrhenius' formulæ are applicable only to a limited concn. range of starch hydrolysis products, and not at all to starch sols. The mol. wts. calc. from Staudinger's formula are : potato starch 165,000, sol. starch 9000—13,500, amylodextrin 12,350, erythrodextrin 4000, and achroodextrin 2900. R. T.

Hydrophilic properties of cellulose.—See B., 1938, 1396.

Conversion of cellulose hydrate into natural cellulose.—See B., 1938, 1397.

Fractional precipitation and viscosity of cellulose acetates. G. R. LEVI (Gazzetta, 1938, **68**, 589—592).—[with U. VILLOTTA]. Vals. of η for solutions of fractionally pptd. cellulose di- and tri-acetates in various solvents are recorded.

[with M. MONTICELLI]. Milling of cellulose di-acetate before dissolving it brings about a marked decrease in η of the resulting solution in $COMe_2$. O. J. W.

Heterogeneous equilibrium of protein solutions. II. **Interaction of salts with proteins. New type of calcium amalgam electrode.** N. R. JOSEPH (J. Biol. Chem., 1938, **126**, 389—402; cf. A., 1937, I, 80).—Decomp. of amalgam in the electrode cell is prevented by a Cellophane membrane which, when in equilibrium with the solution, introduces no significant potential. Results obtained with the electrode agree with those of solubility studies and with those obtained with flowing amalgam electrodes. The effect of $CaCl_2$ on the activity coeff. of serum-albumin (I), of $CaCl_2$ and NaCl on those of ψ-globulin

(II) and carboxyhæmoglobin (III), and of $CaCl_2$, $MgCl_2$, and $ZnCl_2$ on that of gelatin (IV) has been measured. In each case the coeff. is reduced, the magnitude of the reduction increasing in the order (III), (I), (IV), (II).   W. McC.

Solubility of " lyophile " gelatins.—See B., 1938, 1461.

Emission of short-wave ultra-violet radiation in structure building. I. Radiation in typical coagulation. A. RABINERSON and M. FILIPPOV (Acta Physicochim. U.R.S.S., 1938, 8, 419—440).— Investigations with a photo-electron counter (data given) show that the coagulation of sols of $Fe(OH)_3$ by Na_2SO_4 or $(NH_4)_2SO_4$, of V_2O_5 by KCl, and of Na oleate, but not of As_2S_3, by NaCl is accompanied by the emission of ultra-violet radiation of low intensity. Data obtained with yeast as detector, in agreement with the above, show that these coagulations are accompanied by a mitogenetic effect. Dilution of the sols or of the coagulating electrolytes does not produce the effect. Biological detectors should be used in the investigation of radiation due to physico-chemical processes.   L. S. T.

Electrolyte coagulation and coefficient of electrolyte activity. W. OSTWALD (J. Physical Chem., 1938, 42, 981—1000).—A summary of work previously published (A., 1936, 157, and subsequent abstracts).   C. R. H.

Specific effects of cations in the flocculation and discharge of negative bio-colloids. H. G. B. DE JONG (Chem. Weekblad, 1938, 35, 783—790).— A review of the flocculation of org. colloids containing CO_2H (arabates, pectates), phosphatide (lecithin, nucleates) and SO_4H (agar, carragheen, chondroitin-H_2SO_4) groups with electrolytes and dehydrating agents (EtOH, $COMe_2$). The results can be explained on modern electrochemical theory.   S. C.

Surface solvation in disperse systems. IV. Desolvation of rubber sols in media of different polarities. V. MARGARITOV and B. KOVARSKAJA (Acta Physicochim. U.R.S.S., 1938, 8, 377—384).— The coagulation of rubber sols in C_6H_{14}, C_8H_{18}, C_2HCl_3, CCl_4, C_6H_6, and cyclohexane by $COMe_2$, and in C_6H_{14}, cyclohexane, and C_6H_6 by PrOH, BuOH, and $C_9H_{19}{\cdot}OH$ has been investigated. The amount of $COMe_2$ or PrOH or BuOH required to coagulate the sols increases with the mol. wt. of the dispersion media. $C_9H_{19}{\cdot}OH$ produces no coagulation of rubber sols in C_6H_6 or C_6H_{14}. Systems in which surface solvation is probable (C_6H_{14}) are more stable than those in which rubber undergoes vol. solvation (CCl_4).   L. S. T.

Dissolution of insoluble dyes in aqueous detergents. J. W. McBAIN and T. M. WOO (J. Physical Chem., 1938, 42, 1099—1111).—The partition of Yellow AB between C_6H_6 or PhMe and detergents, pure soaps, and laurylsulphonic acid has been investigated. The dye is brought into aq. solution by spontaneous colloid stabilisation, the amount increasing with increasing concn. of the detergent or stabilising colloid. Stabilisation is more closely related to surface activity than to colloidality of the detergent.   C. R. H.

Peptisation of " oleocarbons " in benzene solution by organic acids. A. GILLET, A. PIRLOT, and F. MONFORT (Bull. Soc. chim. Belg., 1938, 47, 525—531).—By addition of a large vol. of light petroleum to the solution obtained by extracting coal with anthracene oil and oleic acid (I) a ppt. is obtained of " oleocarbon," apparently a compound of (I) with C. After washing thoroughly to remove residual (I) the product is only partly sol. in C_6H_6, but is peptised by small amounts of AcOH, (I), or anthracene oil.   J. W. S.

Cataphoresis of gas bubbles. A. KLEMM (Physikal. Z., 1938, 39, 783—793).—Although the cataphoretic velocity of solid particles is independent of their size, gas bubbles migrate the more rapidly the smaller is their diameter. The theory of cataphoresis of solid particles is extended to cover cataphoresis of spheres with a given viscosity.   A. J. M.

Equilibrium between molecular and colloidal substances in aqueous soap solutions. I. Hydrolysis of fatty acid salts. J. STAUFF (Z. physikal. Chem., 1938, 183, 55—85).—The OH' activities of solutions of Na stearate, palmitate, myristate, and laurate have been determined potentiometrically, and the data are compared with data of other investigators. The increase in OH' activity which accompanies increase in concn. ceases at a crit. concn., c, characteristic of each salt, above which micelle formation takes place. With increase in the no. of C in the acid mol., $\log c$ decreases linearly. A mechanism for the hydrolysis based on the formation of fatty acid double ions is discussed. The mol. solubility $= Fc$, where F ($= \sim 1$), is a function of the total concn. and depends on the individual properties of the colloid.   C. R. H.

Acid–base theory of Brönsted. P. C. VAN KEEKEM (Chem. Weekblad, 1938, 35, 815—821).—A review and a discussion.   S. C.

Dissociating powers of chlorinated hydrocarbons. J. P. W. A. VAN BRAAM HOUCKGEEST (Chem. Weekblad, 1938, 35, 790—795).—Ionisation consts. (α) for $NPr^a{}_4I$ dissolved in EtCl, $(CH_2Cl)_2$ (I), $CHMeCl_2$ (II), $CH_2Cl{\cdot}CHCl_2$ (III), $CMeCl_3$ (IV), $(CHCl_2)_2$ (V), $CH_2Cl{\cdot}CCl_3$ (VI), and $CHCl_2{\cdot}CCl_3$ (VII) are calc. from conductivity measurements at 25°. In dissociating power. (I) $>$ (II), (III) $>$ (IV), (V) $>$ (VI), and in the group (I), (III), (V), (III) is the weakest. α increases with solubility except with (III), in which the salt dissolves in the undissociated state. This is ascribed to the high solvation energy of the dipolar solvent.   S. C.

Standardisation of hydrogen-ion determinations. II. Standardisation of the p_H scale at 38°. D. I. HITCHCOCK and A. C. TAYLOR (J. Amer. Chem. Soc., 1938, 60, 2710—2714; cf. A., 1937, I, 620).—From e.m.f. measurements of cells of the type H_2|buffer or acid solution, KCl (satd.), HCl (0·1N.)|H_2 ($+$), p_H vals. have been assigned to several standard solutions at 38°, including 0·1N-HCl (p_H 1·082), and 0·1N-AcOH in 0·1N-NaOAc (p_H 4·655). These vals. serve to establish a p_H scale, which may be used to obtain the vals. of thermodynamic dissociation consts. at 38°.   E. S. H.

First thermodynamic ionisation constant of deuterocarbonic acid at 25°. J. CURRY and C. L. HAZELTON (J. Amer. Chem. Soc., 1938, 60, 2773—2776).—The ratio of the consts. for H_2CO_3 and D_2CO_3, determined potentiometrically using a cell without transference and having quinhydrone and Ag–AgCl electrodes, is $K_H : K_D :: 2.68 : 1$.

E. S. H.

Calculation of the dissociation constant of weak acids in water–deuterium oxide mixtures. F. BRESCIA (J. Amer. Chem. Soc., 1938, 60, 2811—2813).—Good agreement with experimental data is obtained when a correction is applied to the equation of Korman and La Mer (A., 1936, 1202).

E. S. H.

Conductance and ionisation constants of propionic and n-butyric acids in water at 25°. D. BELCHER [with, in part, T. SHEDLOVSKY] (J. Amer. Chem. Soc., 1938, 60, 2744—2747).—Data for the above acids and their Na salts have been determined and limiting conductances and ionisation consts. derived. Limitations of the extrapolation method for deriving these vals. for weak electrolytes are discussed.

E. S. H.

Reactivities and basic strengths of p-alkyldimethylanilines. W. C. DAVIES (J.C.S., 1938, 1865—1869).—The dissociation consts. (p_K) of the bases p-$C_6H_4R\cdot NMe_2$ at 20° in 50% EtOH (R = H, me, Et, Pr$^\alpha$, Pr$^\beta$, Bu$^\alpha$, sec.-Bu, Bu$^\beta$, Bu$^\gamma$) have been determined, and the rates of their reactions with MeI in aq. $COMe_2$ at 35°, 45°, and 55° measured. There is a linear relationship between p_K and the log of the velocity coeff. The effects of the various substituents in increasing the basic strength and the reactivity to MeI are in the order Me > Pr$^\beta$ > Bu$^\gamma$ and Et > Bu$^\alpha$ > Pr$^\alpha$ > H ~ Bu$^\beta$. Possible explanations of this order are discussed. The factor E in the Arrhenius equation is almost const., the changes in rate being due to changes in the factor P.

F. J. G.

Dissociation constants of piperidine and its homologues. W. F. K. WYNNE-JONES and G. SALOMON (Trans. Faraday Soc., 1938, 34, 1321—1324).—Data are recorded for $(CH_2)_8{>}NH$, $(CH_2)_{17}{>}NH$, $(CH_2)_{15}{>}NMe$, and $(CH_2)_5NMe$. The differences are small; the introduction of Me has a greater effect than the size of the ring. Heats of ionisation follow the same course. The dissociation consts. of piperidine in H_2O determined at 15° and 25° are respectively 1.10 and 1.15×10^{-3}. E. S. H.

Intra-complex coloured compounds. III. Constants of alizarin and alizarates. Colorimetric determination of iron and aluminium. A. K. BABKO (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 49—69).—The absorption spectra of alizarin (I) solutions at p_H 3—13 have been studied, using a series of colour filters. (I) behaves as a dibasic acid, H_2A, with $K_1 = 3 \times 10^{-6}$ and $K_2 = 3 \times 10^{-10}$. Formation of Al alizarate (II) begins at p_H 3, and is complete at p_H 5; the salt is stable up to p_H 11.5, above which it decomposes, yielding aluminate and fully dissociated (I). The absorption spectrum of (II) is almost identical with that of HA', over the range 300—700 mμ.; its dissociation const. is 3×10^{-6}.

That of Fe alizarate is 1.6×10^{-6}, and its absorption spectrum does not differ from that of (II) or HA' at 450—580 mμ, but has an additional band at 600—630 mμ. Traces of Al and Fe are determined in the following way. 2 ml. of 0.03% (I) are added to the solution (containing 2—40 g. of $Al_2O_3 + Fe_2O_3$), followed by 1 ml. each of N-NaOAc and -AcOH (p_H 4.6), and the vol. is made up to 15 ml. The absorption given by the resulting solution, using a filter absorbing light of λ other than 450—520 mμ., is determined, and the Fe + Al content is read from an empirical curve. Fe alone is determined similarly, using a filter transmitting light of λ 600—640 mμ.; Al is given by difference.

R. T.

Association of acetic acid, of its three chlorinated derivatives, and of n-butyric and hexoic acids dissolved in benzene : dielectric polarisation compared with cryoscopic measurements. R. J. W. LE FÈVRE and H. VINE (J.C.S., 1938, 1795—1801).—ρ and ϵ have been determined for solutions in C_6H_6 at 25° down to high dilution of the above acids and of $CH_2Cl\cdot CO_2Et$, $CHCl_2\cdot CO_2Et$, and $CCl_3\cdot CO_2Et$. The three esters show a linear dependence of ϵ on concn., and their dipole moments are 2.64, 2.61, and 2.55 D., respectively. With the three fatty acids small departures from linearity are found at concn. <2%, indicating incipient dissociation of the double mols., whilst with the chloroacetic acids, especially $CCl_3\cdot CO_2H$ (I), there are marked deviations indicating dissociation to a more polar single mol. From the results the degree of association of (I) has been calc.; the equilibrium const. is 24 l. g.-mol.$^{-1}$, and the apparent moment of the double mol. is 1.1 D. F. J. G.

Association of p-toluenesulphonmethylamide and related compounds in solution : comparison of dielectric polarisation and cryoscopic measurements. R. J. W. LE FÈVRE and H. VINE (J.C.S., 1938, 1790—1795).—If a solute is associated to a definite polymeride the dipole moment of which may be assumed = 0, measurements of ϵ may be used to determine the degree of association. Vals. obtained for $NPh:N\cdot NHPh$ do not agree with those obtained cryoscopically by Hunter (A., 1937, II, 144), so that some of the polymeric mols. are probably of the highly polar open-chain form. ϵ has been measured for p-$C_6H_4Me\cdot SO_2\cdot OMe$ (I), p-$C_6H_4Me\cdot SO_2\cdot NMe_2$ (II), and p-$C_6H_4Me\cdot SO_2\cdot NHMe$ (III), in C_6H_6, $CHCl_3$, and Et_2O, at 25°. ϵ is a linear function of concn. for (I) and (II) which are not associated, and for (III) in Et_2O, but in C_6H_6 and $CHCl_3$ (III) shows a marked deviation from linearity due to association. Vals. for the degree of association calc. on the assumption that a non-polar dimeride is present are < those found cryoscopically by Chaplin and Hunter (A., 1937, I, 513) and are not in agreement with the mass law. The dipole moments of (I), (II), and (III), in C_6H_6 are 5.18, 5.48, and 5.4 D., respectively. F. J. G.

Use of dielectric polarisations in the investigation of the formation of intermolecular complexes in solution. D. L. HAMMICK, A. NORRIS, and L. E. SUTTON (J.C.S., 1938, 1755—1761).—The assumptions and the reasoning employed by Earp and

Glasstone (A., 1936, 150) in interpreting their results are criticised. Other methods for deriving vals. of the association const. and mol. polarisation of an intermol. complex from measurements of ϵ for binary mixtures are discussed, and shown to give improbable results when applied to typical systems. It is concluded that measurements of ϵ for solutions of the two components in a third inert liquid, combined with independent (e.g., cryoscopic) estimates of the degree of association, can alone give significant results, and that even when the degree of association is unknown they permit a qual. comparison of various systems. In this way it is shown that NEt_3 combines readily, Pr^β_2O less readily, and $MeNO_2$ scarcely at all, with $CHCl_3$. Data on ϵ for the following systems are recorded: $CHCl_3$-Et_2O at $0°$, $CHCl_3$-Pr^β_2O at $0°$ and $25°$, mixed solutions in C_6H_6 at $25°$ of $CHCl_3$ and Pr^β_2O, $CHCl_3$ and NEt_3, $CHCl_3$ and $MeNO_2$, and solutions in C_6H_6 at $25°$ of $CHCl_3$, Pr^β_2O, NEt_3, and $MeNO_2$. F. J. G.

Physico-chemical study of reactions in organic solution. Use of the specific inductive capacity. P. LAURENT (Ann. Chim., 1938, [xi], 10, 397—483; cf. A., 1931, 894; 1934, 1212; 1935, 1488).—Details are given of the use of measurements of ϵ to detect compound-formation between org. substances in inert solvents. Data on ϵ for a large no. of systems consisting of solutions of pairs of substances (carboxylic acids, phenols, N bases) in C_6H_6 and other solvents are recorded. The existence in solution of the following compounds in addition to those already reported is indicated: $2:4$-$C_6H_3(NO_2)_2$·OH,NH_2Ph; o-$C_6H_4(NO_2)$·OH,$NPhMe_2$; o-, m-, and p-C_6H_4·NH_2Me·OH,$PhOH$; $BzOH$,C_5H_5N; o-$C_6H_4(NO_2)$·OH,C_5H_5N; β-$C_{10}H_7$·OH,C_5H_5N; pyrrole,C_5H_5N; o-NH_2·C_6H_4·CO_2H,C_5H_5N; o-$C_6H_4(OH)_2$,$2C_5H_5N$; (·CMe:N·$OH)_2$,$2C_5H_5N$; $1:3:5$-$C_6H_3(OH)_3$,$2C_5H_5N$; $1:3:5$-$C_6H_3(OH)_3$,$3C_5H_5N$; quinoline,$PhOH$; azoxybenzene, $2:4$-$C_6H_3(NO_2)_2$·OH; phenazine,o-NO_2·C_6H_4·OH; phenazine,$2o$-NO_2·C_6H_4·OH; phenazine,$2:4$-$C_6H_3(NO_2)_2$·OH; phenazine,$2[2:4$-$C_6H_3(NO_2)_2$·$OH]$; $(C_6H_4$·$NH_2)_2$,o-NO_2·C_6H_4·OH; $(C_6H_4$·$NH_2)_2$,$2o$-NO_2·C_6H_4·OH; $(C_6H_4$·$NH_2)_2$,$2:4$-$C_6H_3(NO_2)_2$·OH; $(C_6H_4$·$NH_2)_2$,$2[2:4$-$C_6H_3(NO_2)_2$·$OH]$ $NHPh$·NH_2,C_5H_5N; $NHPh$·NH_2,o-NO_2·C_6H_4·OH; $NHPh$·NH_2,$2[2:4$-$C_6H_3(NO_2)_2$·$OH]$; $(NHPh)_2$,$2:4$-$C_6H_3(NO_2)_2$·OH; $(NHPh)_2$,$2[2:4$-$C_6H_3(NO_2)_2$·$OH]$; $(NHPh)_2$,C_5H_5N; $(NHPh)_2$,$2C_5H_5N$. $PhOH$ with C_5H_5N and piperidine with $PhOH$ give abnormal curves which are interpreted as indicating an equilibrium between $1:1$ and $2:1$ compounds. F. J. G.

Evidence of a complex between nitrobenzene and carbon tetrachloride. B. SOUČEK (Coll. Czech. Chem. Comm., 1938, 10, 459—465).—Variations with composition of γ, ρ, and n, measured at $15°$, $20°$, and $44°$ for mixtures of $PhNO_2$ and CCl_4, indicate the existence of a complex $PhNO_2$,CCl_4. The determined $[P]$ of the complex is $486·2$, and since the determined $[P]$ of the mixtures agree closely with those calc. from the vals. for the complex and the pure

components, simple dissolution of the complex in excess of either component is indicated. F. H.

Theory of fugacity. I. M. V. TOVBIN. II. Fugacity of real gases. M. V. TOVBIN and KOZAKOVA. III. Fugacity and activity of solutions. IV. Thermodynamics of real solutions. V. Velocity of dissolution, and activity of solutions. VI. Heat of evaporation of solutions. VII. Diffusion coefficient, conductivity, and activity of solutions. VIII. Activity and heat of solvation of dissolved substances. M. V. TOVBIN (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 221—227, 229—233, 235—240, 241—245, 247—250, 251—258, 259—263, 265—279).—I. The fugacity of liquids and solids is assumed to be identical with the rate of (hypothetical) expansion into vac. under given conditions. On this assumption many of the characteristic properties of gases and solutions may be derived, on the basis of the kinetic theory.

II. The vals. of the fugacity coeff. F_ψ of O_2 and CO_2, at 1—90 atm., calc. from $F_\psi = Ve^{-a/RTV}/(V - b)$, where V is the vol. of 1 g.-mol. of gas under the given conditions, and a and b are the van der Waals consts., agree well with those derived by Lewis' method.

III. The expression $F_\psi = RTe^{L/RT}/1·325P(v - b)$, where L is the latent heat of vaporisation of the solvent, P is its saturated v.p., and v is the vol. of solution containing 1 g.-mol. of solvent, is derived; as a first approximation $F_\psi =$ the accommodation coeff. Expressions for the activity of the solvent and solute in solutions, and for calculating the L of the solvent, are further derived from this expression.

IV. Expressions for the saturated v.p., osmotic pressure, depression of f.p. and elevation of b.p., of solutions are derived, on the above theoretical assumptions.

V. Expressions connecting the fugacity and activity of a dissolved solid with its velocity of dissolution are derived; a conclusion is that the activity of solutes in dil. solutions is $\propto$ concn.

VI. Expressions for calculating the true heat of vaporisation of solvents from solutions, and for the approx. evaluation of the activity of such solvents, are given. It is shown, on theoretical grounds, that the processes of vaporisation and condensation of pure solvents have definite activation energies, which differ from those in solutions by amounts equal to the differential heat of dilution of the solutions. An expression approx. connecting heat of dilution with temp. is derived.

VII. Kohlrausch's empirical equation connecting equiv. conductivity with concn. is derived theoretically. An equation relating the diffusion coeff. with the activity coeff. for dil. solutions is derived from the Einstein–Smoluchowski formulæ.

VIII. Expressions for the fugacity and activity of dissolved substances are derived, and a method of calculating by their use the heat of solvation of solutes is given; the method applies only to cases in which compounds with solvent are not formed. R. T.

Determination of activity coefficients from the potentials of concentration cells with transference. D. A. MACINNES and A. S. BROWN (Chem. Rev., 1936, 18, 335—346).—Vals. of the activity

coeffs. of NaCl and $AgNO_3$ in aq. solution at 25° are calc. from measured potentials of concn. cells with liquid junctions, and transference nos. CH. ABS (e)

Copper thioaluminates. G. G. MONSELISE (Gazzetta, 1938, **68**, 600—601; cf. A., 1937, I, 628).—The thermal diagram of the system Cu_2S–Al_2S_3 up to about 1200° shows the existence of the compound $4Cu_2S,Al_2S_3$, analogous to $4Cu_2S,SiS_2$.   O. J. W.

Relationship of beryllium to the vitriol-forming group and the alkaline-earth metals. IV. III. Double-salt formation between potassium and beryllium sulphates in comparison with that of the vitriols. (Polytherms of the ternary system $BeSO_4$–K_2SO_4–H_2O between 0° and 100°.) W. SCHRÖDER [with W. KLEESE] (Z. anorg. Chem., 1938, **239**, 399—417).—The 0°, 25°, 50°, 75°, and 99·5° isotherms of the system have been determined. The only double salt is $K_2SO_4,BeSO_4,2H_2O$, which has a wide region of stability over the whole temp. range. The 25° isotherm differs markedly from that given by Britton and Allmand (J.C.S., 1921, **119**, 1463), whose work is criticised.   F. J. G.

Transition point of calcium sulphate in water and concentrated sea-water. T. TORIUMI and R. HARA (Tech. Rep. Tôhoku, 1938, **12**, 572—590).— The transition points between $CaSO_4,2H_2O$ (I) and $CaSO_4,0·5H_2O$, and between (I) and the insol. form of $CaSO_4$ (III), as measured by solubility determinations, are 98·4° and 38°, respectively, in contact with pure H_2O. The transition points are lowered progressively with increasing [NaCl], and from the data obtained the free energy changes of the transitions at various temp. and the heats of hydration at the transition points are deduced. The solubility of (III) in H_2O and in NaCl solutions (16—163 g. per l.) has been measured at 40—100°.   J. W. S.

Alkaline earth arsenates. System As_2O_5–BaO–H_2O at 17°. H. GUÉRIN (Bull. Soc. chim., 1938, [v], **5**, 1472—1478).—A detailed account of work already noted (A., 1938, I, 359).   E. S. H.

Binary system cadmium nitrate–water : vapour pressure–temperature relations. W. W. EWING and W. R. F. GUYER (J. Amer. Chem. Soc., 1938, **60**, 2707—2710).—Data for the concn. range 0—86% and 20—60° are recorded. Babo's const. increases appreciably with rising temp. in this system. E. S. H.

System water–sulphur trioxide. H. C. S. SNETHLAGE (Rec. trav. chim., 1938, **57**, 1311).— Incorrect vals. for $k = Ae^{-E/RT}$ previously published (cf. A., 1937, I, 517) are corr.   C. R. H.

Magnetochemical studies. XXX. Phase relationships and magnetic behaviour in the system chromium–selenium. H. HARALDSEN and F. MEHMED (Z. anorg. Chem., 1938, **239**, 369—394).— X-Ray investigations, and measurements of χ, in the system Cr–Se between 50 and 60 at.-% of Se show the existence of three homogeneous phases separated by two-phase regions, viz., a hexagonal α-phase, B-8 type, a β-phase of lower symmetry, possibly monoclinic, and a hexagonal γ-phase which has a structure nearly related to that of the α-phase and is probably of B-8 type with vacant spaces in the Cr

lattice. The α-phase extends from 50 at.-% Se, with a 3·68, c 6·02 A. (cf. A., 1927, 815), to ~53·5 at.-% Se, with a 3·67, c 5·985 A. The β-phase extends from ~54·5 at.-% Se, with a 6·35, b 3·64, c 5·93 A., to ~58 at.-% Se, with a 6·29, b 3·60, c 5·84 A. The γ-phase extends from ~59 to ~60 at.-% Se, the lattice dimensions being approx. const., viz., a 3·60, c 5·78— 5·77 A. χ has been measured from −183° to 320°. Ferromagnetism docs not occur, and from 57·85 to 58·85 at.-% of Se the simple Curie law holds; for the other preps. the Curie–Weiss law holds, with negative and usually small vals. for θ. The mol. moments are in approx. agreement with the theoretical vals. for ionic binding. The systems Cr–S, Cr–Se, and Cr–Te are compared.   F. J. G.

Piezometric researches. IV. Influence of high pressures on the fusion curve of binary mixtures. L. DEFFET (Bull. Soc. chim. Belg., 1938, **47**, 461—517).—Data are recorded for the binary systems p-$C_6H_4Cl_2$–p-$C_6H_4Br_2$, NH_2Ph–PhOH, o-cresol–m-cresol, cyclohexane–NH_2Ph, and C_6H_{14}–$PhNO_2$. The variations in the fusion curves with increasing pressure are in accord with previous observations (cf. A., 1935, 1060).   J. W. S.

Heats of combustion of diamond and of graphite. R. S. JESSUP (J. Res. Nat. Bur. Stand., 1938, **21**, 475—490).—The average val. for the heat of combustion to CO_2 of three graphites is 393·396 international kilojoules per mol. at 25° and 1 atm. Of two samples of diamond, the finer gave 395·771 and the coarser 395·287 international kilojoules per mol. at 25° and 1 atm. The difference between the two vals. is not explained, but it is not considered to be due to the two types of diamond discovered by Robertson et al. (cf. A., 1934, 583). The val. for the coarser specimen is considered the more reliable as the possibility of surface effects is less. C. R. H.

Heat and free energy of formation of carbon dioxide, and of the transition between graphite and diamond. F. D. ROSSINI and R. S. JESSUP (J. Res. Nat. Bur. Stand., 1938, **21**, 491—513).— Existing data for the entropies of O_2, CO_2, graphite, and diamond, and for the heats of combustion of the two latter substances, are reviewed, and "best" vals. for the heats, entropies, and free energies of formation of CO_2 and of transition between graphite and diamond are selected.   C. R. H.

Heats of combustion of anthracite cokes and of artificial and natural graphites. P. H. DEWEY and D. R. HARPER (J. Res. Nat. Bur. Stand., 1938, **21**, 457—474).—The heats of combustion, q, of 30 anthracite cokes of six different H contents and of two artificial and four natural graphites have been measured. q increases almost linearly with H content, but there is no definite relation between q and adsorptive capacity towards CO_2.   C. R. H.

Heats of formation of various nitrides. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1356—1363).—By tabulating the heats of formation of various nitrides and azides against the at. nos. of their constituent elements, the heats of formation of the nitrides of As, Se, Br, and Hf have

been predicted as follows : $0.5(N_2) + As = AsN - 33.9$; $0.5(N_2) + Sc = ScN + 75.0$; $0.5(N_2) + 1.5(Br_{2liq.}) = NBr_3 - 80.3$; $0.5(N_2) + Hf = HfN + 78.3$ kg.-cal.   W. R. A.

Heats of organic reactions. VII. Additions of halogens to olefines. J. B. CONN, G. B. KISTIAKOWSKY, and E. A. SMITH (J. Amer. Chem. Soc., 1938, **60**, 2764—2771; cf. A., 1938, I, 199).—The following heats of reaction (in g.-cal. per g.-mol.) refer to 355° K. and 1 atm. total pressure : $C_2H_4 + Br_2 = C_2H_4Br_2 - 29,058 \pm 300$, $C_3H_6 + Br_2 = C_3H_6Br_2 - 29,412 \pm 200$, $CH_2{:}CHEt + Br_2 = CH_2Br{\cdot}CHBrEt - 29,585 \pm 200$, trans-$CHMe{:}CHMe + Br_2 = i{\text{-}}CHBrMe{\cdot}CHBrMe - 29,075 \pm 200$, cis-$CHMe{:}CHMe + Br_2 = d,l{\text{-}}CHBrMe{\cdot}CHBrMe - 39,177 \pm 200$, $CMe_2{:}CHMe + Br_2 = CMe_2Br{\cdot}CHBrMe - 30,394 \pm 200$, $C_2H_4 + Cl_2 = C_2H_4Cl_2 - 43,653 \pm 120$. A rule, which permits the calculation of accurate heats of addition of H halides and of substitution of Br, is formulated.   E. S. H.

Relation between heats of fusion of intermetallic compounds and the m.p. ; calculation of heats of formation and of mixing. O. KUBASCHEWSKI and F. WEIBKE (Z. Metallk., 1938, **30**, 325—326).—If, in the formation of a compound A_mB_n (m.p. $= T°$ abs.) between two metals A and B with heats of fusion Q_1 and Q_2, the heat evolved in mixing the liquid metals is Q_3, and Q_4 is the heat of formation of the compound, then $Q_4 - Q_3 = 3.5T - (mQ_1 + nQ_2)$, where m and n are the at.-% of the components. Vals. of Q_4, Q_3, and T are tabulated for 21 intermetallic compounds.   A. R. P.

Heats of dissolution and heats of reaction in liquid ammonia. V. Alkali and alkaline-earth metals. F. C. SCHMIDT, F. J. STUDER, and J. SOTTYSIAK (J. Amer. Chem. Soc., 1938, **60**, 2780—2782; cf. A., 1937, I, 138).—Procedure for the prep. of pure Rb and Cs from their halides is described. The at. heats of dissolution of K, Rb, and Cs over a fairly wide concn. range are zero; those of Li, Ca, Ba, and Sr have been determined at different concns. and these metals are shown to have a negative heat of dilution.   E. S. H.

Heats of dissolution of gaseous di- and trimethylamines. A. PATTERSON, jun. [with W. A. FELSING] (J. Amer. Chem. Soc., 1938, **60**, 2693—2695).—The relation between the heat of dissolution in g.-cal. per mol. ($-\Delta H$) and dilution in mol. H_2O per mol. amine (N) is given by $-\Delta H_1(NHMe_2) = 12,470 + 0.35149N$ and $-\Delta H_2(NMe_3) = 12,344 + 0.31645N$.

Effects of dipole interaction on heats of adsorption. J. K. ROBERTS (Trans. Faraday Soc., 1938, **34**, 1342—1346).—Theoretical. The variation of heat of adsorption with fraction of surface covered is considered for the adsorption of vapours with a permanent dipole moment on conductors. The variation is small for typical mols., since the effects of dipole interaction and of the van der Waals attraction between the adsorbed mols. are of the same order and of opposite sign.   E. S. H.

Induced dipoles and the heat of adsorption of argon on ionic crystals. J. K. ROBERTS and W. J. C. ORR (Trans. Faraday Soc., 1938, **34**, 1346—1349).—The electrostatic field at points equidistant from four ions near the surface of a 100 plane in a body-centred alkali halide crystal has been calc. The effect of the dipole induced by this field in A adsorbed by CsI makes the variation in heat of adsorption with fraction of surface covered considerably $<$ it would be if only van der Waals forces were acting.   E. S. H.

Conductance of dilute solutions of alkali iodides in dimethylamine. E. SWIFT, jun. (J. Amer. Chem. Soc., 1938, **60**, 2611—2614).—Data recorded for NaI, KI, and LiI agree qualitatively with the Kraus and Fuoss theory (A., 1934, 967). Li· is probably solvated by $NHMe_2$.   E. S. H.

Conductivities of concentrated mixtures of the nitrates of uni-, bi-, and ter-valent cations in aqueous solution. P. VAN RYSSELBERGHE and G. LEE (J. Amer. Chem. Soc., 1938, **60**, 2776—2779).—Conductivities of 20 binary mixtures have been measured at total equiv. concns. of 1—5N. The vals. are $<$ those calc. from the simple mixture rule, except for $Cr(NO_3)_3 + Cd(NO_3)_2$ and $Cr(NO_3)_3 + Al(NO_3)_3$. The deviation is the greater the greater is the difference of the conductivities of the single salts.   E. S. H.

Dispersion of conductivity of multivalent electrolytes in aqueous solution. J. P. VAN DER HAMMEN (Physica, 1938, **5**, 833—844; cf. A., 1938, I, 519).—The increase in conductivity of aq. solutions of multivalent electrolytes at high frequency (λ 8 m.) is only qualitatively in accord with the Debye–Falkenhagen theory. For aq. $[Co\ en_3][Fe(CN)_6]$ the effect is $>$ that calc. on the assumption that free ions only contribute to the increase. It is considered probable that ion pairs may also add to the effect through dipolar adsorption.   J. W. S.

Conductivity of hydrogen halides in anhydrous acetic and propionic acids. M. HŁASKO and E. MICHALSKI (Rocz. Chem., 1938, **18**, 220—227).—The conductivity (κ) of HCl in anhyd. AcOH is $<$ of HBr; that of HI cannot be determined, owing to decomp. The κ of HCl in anhyd. $EtCO_2H$ is zero, and of HBr $<$ HI. In AcOH max. κ is obtained with M-HCl or 1·4M-HBr, and min. κ with 0·3M-HCl or 0·025M-HBr; this is in disagreement with the Walden formula, according to which the concn. at which min. κ is obtained depends only on the ϵ of the solvent.   R. T.

Effect of a non-conducting admixture of Sb_2S_3 on the conductivity of solid Ag_2S. P. Z. FISHER (Bull. Sci. Univ. Kiev, 1937, **3**, No. 3, 139—149).—The conductivity of Ag_2S is lowered by admixture of Sb_2S_3, to an extent $\propto$ concn. of the latter. It rises with increasing temp., gradually below 120°, rapidly above it, owing to formation of a conducting double compound.   R. T.

Transport numbers of paraffin chain salts in aqueous solution. II. Reply to objections. G. S. HARTLEY. **III. Measurements on salts : influence of valence and nature of the gegenion.** C. S. SAMIS and G. S. HARTLEY (Trans. Faraday

Soc., 1938, 34, 1283—1288, 1288—1305).—II. A reply to criticism (cf. A., 1936, 799).

III. Conductivities and transport nos. have been determined for cetylpyridinium chloride, acetate, iodide, oxalate, and sulphate, trimethylcetylammonium sulphate, trimethyldodecylammonium bromide, and Ag, Zn, and Cu dodecyl sulphates in H_2O at 35—50°. Changes in conductivity observed when the gegenion associated with a given paraffin chain ion is changed are due to changes in the fraction of gegenions attached to the micelle and in the size of the micelle. In this respect, sp. properties of the gegenions are at least as important as their valency; as regards mobility of the micelle, the valency of the gegenion appears to be predominant, and there is little sp. influence. Sp. variations of size are levelled out by admixture with simple salts.

E. S. H.

Interpretation of an experiment of Chanoz and Ponthus on the electrolysis of dichromated gelatin. J. SWYNGEDAUW (Compt. rend. Soc. Biol., 1938, **128**, 1144—1146).—The coloured zones described by Chanoz and Ponthus (ibid., 1934, **115**, 522) are due to formation of a colourless isoelectric zone, development of a red zone of chromic acid being caused by migration of Cr_2O_7'' across the isoelectric portion. H. G. R.

Thermodynamics of a two-electrode system with two unretarded ionic transitions in the absence of a current. E. LANGE and K. NAGEL (Z. Elektrochem., 1938, **44**, 792—813; cf. A., 1935, 1204; 1936, 430).—Theoretical. J. W. S.

Theoretical studies on electrode potential. III. Absolute value of single electrode potential. IV. Solvent action of liquid ammonia on ionic crystals. V. Standard electrode potentials in liquid ammonia. S. MAKISHIMA (J. Chem. Soc. Japan, 1935, **56**, 1192—1198; 1936, **57**, 285—296, 297—307).—The standard electrode potential of halogens and metals in liquid NH_3 has been calc.

CH. ABS. (e)

Studies with the glass electrode in alkaline solutions. D. O. JORDAN (Trans. Faraday Soc., 1938, **34**, 1305—1310).—The deviation Δ of glass electrode potentials from H electrode potentials for alkaline solutions of $Na^{\cdot}$, $Li^{\cdot}$, $K^{\cdot}$, $Ca^{\cdot\cdot}$, $Sr^{\cdot\cdot}$, and $Ba^{\cdot\cdot}$ at different p_H and ionic concns. m is given by log $\Delta = A p_H' + B \log m - C$, where p_H' is the apparent p_H obtained if the glass electrode potentials are treated as H electrode potentials, and A, B, and C are consts. E. S. H.

Metal–metal oxide electrodes. I. Tungsten and molybdenum electrodes. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 345—361).—The dependence of the potential on p_H for a no. of metallic electrodes has been studied. W, Mo, and Sb give a linear relationship over the range p_H 3 to 8. In an atm. of H_2, but not in air or O_2, a bright W electrode gives the theoretical relationship from p_H 2·8 to 9·4, the e.m.f. against the saturated calomel electrode being given by $E = -0·212 + 0·0591 p_H$, at 25°, and the temp. coeff. being 0·00116 v. per degree. From these data the heat

D (A., I.)

of formation of the surface oxide is 194 kg.-cal., in agreement with thermochemical vals. for WO_3. A polished Mo electrode in H_2 gives the theoretical relationship from p_H 5 to 7. F. J. G.

Electrolytic reduction potentials of organic compounds. XXVI. Standard electrolytic reduction potential-p_H curve. I. TACHI (J. Agric. Chem. Soc. Japan, 1938, **14**, 1286—1296; cf. A., 1937, I, 567).—The relation of the standard electrolytic reduction potential Π_0' to the p_H of the electrolytic solution is discussed with regard to the dissociation consts. of a reducible compound as well as of its reduced form. The inflexions of the Π_0'–p_H curve for neutral-red (redox system) are in fair agreement with theory. K_b for neutral-red, and K_b and K_a for the leuco-base, calc. from the inflexion points, are $3·2 \times 10^{-7}$, $1·3 \times 10^{-9}$, and $3·2 \times 10^{-9}$, respectively, at 25°. In the case of benzoylacetone (irreversible reduction system) the inflexions of the curve do not agree so well with theory, but its shape approximates to the theoretical form. At 25° the calc. K_a is $3·2 \times 10^{-7}$, and the first and second K_a for reduced benzoylacetone are $4·0 \times 10^{-4}$ and $1·0 \times 10^{-11}$, respectively. J. N. A.

Streaming of electrolytes in reduction at the dropping mercury electrode. H. J. ANTWEILER (Z. Elektrochem., 1938, **44**, 831—840).—Anomalous max. in the c.d.–p.d. curves for the electrolysis of solutions with a dropping Hg cathode are traced to disturbances in the diffusion layer at the Hg surface, due to streaming in the electrolyte solution. The streaming can be rendered visible; it is influenced by the positions of the electrodes, but not by a strong magnetic field or by superimposing an a.c. Streaming can be caused by momentarily breaking the circuit. E. S. H.

Cathodic polarisation of iron in nitric acid. M. KARSCHULIN (Arh. Hemiju, 1938, **12**, 125—131).—Fluctuations of the potential developed at an Armco-Fe cathode (Pt anode) in 9·2, 14·5, and 11·6N-HNO_3 at different c.d. are recorded. The results obtained are analogous to those reported by Ellingham (A., 1932, 705) for a Pt cathode in HNO_3, and are explained on the basis of Ellingham's results, taking into consideration Karschulin's previous findings (A., 1935, 706, 1325). R. T.

Passivity of iron and steel in nitric acid solution. XXIII. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 751—794).—The electrode potential of Fe in HNO_3 is raised by addition of $Fe(NO_3)_3$, $Hg(NO_3)_2$ or, $AgNO_3$, and the metal becomes more readily passive in these solutions. The addition to HNO_3 of nitrates of Na, Mg, Al, Mn, Zn, Cr, Co, Ni, and Cu has no effect on the passivity. A. J. M.

Oxidation–reduction phenomena in electrolysis by sparking. P. JOLIBOIS (Bull. Soc. chim., 1938, [v], **5**, 1429—1441).—A lecture.

Classical statistical mechanical formulation of the absolute rate of reaction in a general chemical system. K. HIROTA and J. HORIUTI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1174—1180).—The statistical mechanical method of calculat-

ing the abs. rate of reaction (A., 1938, I, 255) has been extended to cover thermal reactions.   A. J. M.

Hydrodynamic theory of detonation. H. LANG-WEILER (Z. tech. Physik, 1938, **19**, 271—283).—Theoretical.   A. J. M.

Theory of explosion phenomena. W. JOST and L. VON MÜFFLING (Z. physikal. Chem., 1938, **183**, 43—54).—The mathematical theory of chain reactions during explosions is discussed.   C. R. H.

Explosion wave in gas mixtures. P. LAFFITTE (Recz. Chem., 1938, **18**, 195—209).—A lecture.   R. T.

Auto-inflammation of gaseous mixtures at short [time] lags. I. Auto-inflammation of mixtures of hydrogen with air. V. STERN, B. KRAVETZ, and A. SOKOLIK (Acta Physicochim. U.R.S.S., 1938, **8**, 461—480).—The auto-inflammation of H_2 + air mixtures has been investigated over a wide range of composition, pressure, and temp. Semenov's formula is applicable to the upper limit of inflammation. Inflammation lags are independent of temp. $\tau p^{1.5}$ = const. expresses the relationship between pressure and lag. The lag has a min. val. for a mixture containing 34% of H_2. The auto-inflammation of H_2-air mixtures in an explosion engine is discussed.   L. S. T.

Energetic study of combustion at constant volume. Fictitious and actual combustion. L. REINGOLD (Compt. rend., 1938, **207**, 717—719; cf. B., 1938, 1120).—A general expression is derived by which the temp. of combustion of gaseous mixtures containing hydrocarbons and H_2 may be calc. from a "fictitious" combustion temp., obtained by assuming no dissociation of the products.   A. J. E. W.

Existence of two slow homogeneous mechanisms in the oxidation of mixtures of hydrogen and carbon monoxide. M. PRETTRE (Compt. rend., 1938, **207**, 674—676; cf. A., 1937, 1, 523).—Introduction of H_2 into CO-O_2 mixtures at 540° results in complete oxidation of the H_2 and of part of the CO. The initial rate of oxidation at first increases rapidly with the $[H_2]$, and then remains const. or decreases slowly over a large $[H_2]$ range; a less pronounced increase occurs at high H_2 pressures. These results indicate the existence of two mechanisms, in close analogy with the oxidation of H_2. Inflammation at low pressures is prevented by partial inhibition of chain branching by the CO.   A. J. E. W.

Application of the tube method for the measurement of the normal speed of flame propagation in gases. L. CHITRIN (Tech. Phys. U.S.S.R., 1937, **4**, 110—120).—Investigations with mixtures of C_6H_6 or CO with air show that the speed of uniform flame movement is not characteristic of the normal speed of propagation but $\propto$ the quantity of mixture ignited in unit time, and depends on the dimensions of the flame surface and conditions of propagation. The val. of the normal speed of inflammation must be determined as the ratio of the vol. of fuel mixture consumed in unit time to the area of surface of inflammation. The tube method allows accurate determination of the normal speed if the shape and

dimensions of the flame surface corresponding with the stage of uniform movement are recorded.   N. M. B.

Systems of " Knallgas " with hydrogen chloride, carbonyl chloride, and difluorodichloromethane (" freon ") as extinguishers. J. J. VALKENBURG (Rec. trav. chim., 1938, **57**, 1283—1293).—When plotted on triangular diagrams the explosion regions of H_2-O_2-HCl and of H_2-O_2-$COCl_2$ are bounded by parabolic curves, but an irregular curve is obtained with H_2-O_2-CCl_2F_2. The irregularities are attributed to side reactions. The data are discussed.   C. R. H.

Explosion limit curves. III. Systems H_2-O_2-N_2, H_2-O_2-CO_2, and H_2-O_2-A. A. J. VALKENBURG (Rec. trav. chim., 1938, **57**, 1276—1282).—The transition from non-explosive to explosive state at the lower explosion limit previously observed (cf. A., 1938, I, 626) is discussed theoretically.   C. R. H.

Oxidation of monogermane and digermane. H. J. EMELÉUS and E. R. GARDNER (J.C.S., 1938, 1900—1909).—Slow oxidation of GeH_4 at 160—183° occurs in accordance with $GeH_4 + 2O_2 = GeO_2 + 2H_2O$. The reaction is catalysed by GeO_2 which is deposited on the walls of the reaction vessel and permits oxidation to occur about 100° lower than on a clean glass surface. At 160—183° the catalysed reaction is approx. of zero order with respect to O_2 and second order with respect to GeH_4. Ignition of GeH_4-O_2 mixtures in glass vessels is preceded by an induction period. The ignition temp. is lowered by increasing the proportion of GeH_4 and by the presence of GeO_2, which also eliminates the induction period. Photochemical oxidation of GeH_4 takes place in accordance with $2GeH_4 + 3O_2 = H_2 + 2H_2O + Ge_2O_4H_2$. The ignition temp. of Ge_2H_6-O_2 mixtures is about 150° < that of GeH_4-O_2 mixtures; the reaction is represented by $2Ge_2H_6 + 7O_2 = 4GeO_2 + 6H_2O$.   E. S. H.

Explosive limits of gaseous mixtures. IV. Acetylenic mixtures. R. BRESQUER, M. RIVIN, and A. SOKOLIK (Acta Physicochim. U.R.S.S., 1937, **7**, 749—754; cf. A., 1936, I, 1468).—The possibility of a spontaneous growth of the explosion wave has been demonstrated in the case of C_2H_2-air mixtures. The zone defined by the explosive limits has two min., as previously found for H_2-air mixtures. This is probably due to a fall of the temp. of ignition in the short lag depending on the dilution of both types of mixtures.   W. R. A.

(A) Mechanism of chain breaking in the thermal decomposition of ethane. (B) Reaction chains in the thermal decomposition of hydrocarbons. Comparison of methane, ethane, propane, and hexane. J. E. HOBBS and C. N. HINSHELWOOD. **(C) Chain reaction in the thermal decomposition of diethyl ether.** J. E. HOBBS (Proc. Roy. Soc., 1938, A, **167**, 438—446, 447—455, 456—463).—(A) The inhibition of the reaction by the presence of NO has been investigated at four different C_2H_6 pressures, between 50 and 450 mm. The predominant mechanism for chain ending in the absence of NO is a ternary collision between two radi-

cals and a C_2H_6 mol.; binary collisions are in some degree effective.

(B) A comparison is made of the inhibition by NO of the thermal decomp. The mean chain length shows no marked change as the series is ascended. Curves showing the decrease in rate as a function of [NO] are explained in terms of a simple theory of chain breaking. Approx. evaluation of the energy of activation of chain propagation shows that it tends to decrease with the higher hydrocarbons.

(c) The reaction inhibited by NO has been studied at 504° at four pressures between 50 and 400 mm. The course of the inhibition curve is independent of the pressure of Et_2O. A chain mechanism explaining the results is put forward.   G. D. P.

Low-temperature oxidation of acetaldehyde. B. V. AIVAZOV (Acta Physicochim. U.R.S.S., 1938, **8**, 617—622).—The induction periods (τ_1 and τ_2) of cold and hot flames in mixtures of MeCHO and O_2 have been investigated. τ_1 decreases with increasing pressure and with increasing [MeCHO], tending to a limit. τ_2, which is small (<0.1 sec.), increases with temp., and decreases with increasing pressure as for C_4H_{10}–O_2 mixtures (cf. A., 1937, I, 34).   W. R. A.

Kinetics of the decomposition of chloropicrin at low pressures. E. W. R. STEACIE and W. McF. SMITH (Canad. J. Res., 1938, **16**, B, 222—226).—The fall in the rate of decomp. at low pressures can be explained on the basis of the Kassel theory for a model with 15 oscillators, a mol. diameter of 8×10^{-8} cm., and a frequency of 779 cm.$^{-1}$ C. R. H.

Decomposition and ignition of peroxides. I. Diethyl peroxide. E. J. HARRIS and A. C. EGERTON (Proc. Roy. Soc., 1938, A, **168**, 1—18; cf. A., 1938, I, 256).—The reaction is studied in the temp. range 130—190°; it is unimol. and is not affected by surface condition of the reaction vessel or by the addition of diluents (He, H_2, CO_2.) A short induction period, which is increased by the addition of NO, is observed. Above a crit. pressure the decomp. becomes explosive. Et_2O_2 ignites in air at temp. < those corresponding with the crit. explosion pressure in a neutral atm. In a C_3H_8–O_2 mixture ignition occurs at temp. < those at which C_3H_8 will ignite, without igniting the C_3H_8. The induction period of the slow combustion of C_3H_8 is greatly diminished by the presence of Et_2O_2.
                    G. D. P.

Polymerisation of styrene in a 50-cycle electric field, and polymerisation of oil in electrical condensers. A. LIECHTI (Helv. Phys. Acta, 1938, **11**, 477—496).—Application of an a.c. field has no effect on the rate of polymerisation (k) of styrene (I) until the potential gradient (X) reaches a crit. val. [43·5 kv. per mm. for pure (I) at 80°]; k then increases suddenly, but is progressively reduced on further increasing X. A preliminary treatment in the a.c. field (X > the crit. val.) increases the rate of purely thermal polymerisation, re-application of the field during the process having a retarding effect. These phenomena explain certain polymerisation effects in condenser oil.   A. J. E. W.

Kinetics of the nitrite–bromine reaction. L. S. CLARKSON, R. O. GRIFFITH, and A. McKEOWN (Trans.

Faraday Soc., 1938, **34**, 1274—1282).—The reaction in H_2O at 0—40° takes place by two simultaneous processes, both unimol. with respect to Br. The rates are proportional to $[NO_2']/(K_3 + [Br'])$ and $[NO_2']^2/[Br'](K_3 + [Br'])$, respectively. Temp. coeffs. and the influence of KBr, NaBr, $NaNO_3$, and KNO_3 have been determined for both reactions. The mechanism of reaction is discussed.   E. S. H.

Factors determining the velocity of reactions in solution. Formation of quaternary ammonium salts. K. J. LAIDLER (J.C.S., 1938, 1786—1789).—In each of the series of reactions between substituted dimethylanilines or pyridines and MeI in $PhNO_2$ the term PZ of the Arrhenius equation is approx. const., changes in velocity being due to changes in E. The order of activation energies is in accordance with the electronic effects of the substituent groups, assuming that a low energy is associated with a high density of electrons on N. α-Picoline is an exception, since E is abnormally high owing to steric hindrance, which is not reflected in a low val. of PZ. The influence of substituents on the velocity of decomp. of the quaternary salts is opposite to that on the velocity of their formation.
                    E. S. H.

Activation energy of organic reactions. IV. Transmission of substituent influences in ester hydrolysis. E. TOMMILA and C. N. HINSHELWOOD (J.C.S., 1938, 1801—1810; cf. A., 1938, I, 405).—Transmission coeffs. have been determined for the influence of various electron-attracting and -repelling groups in the m- and p-position of the C_6H_6 ring on the hydrolysis by acids and alkalis, respectively, in aq. $COMe_2$, of esters of the types $C_6H_4X·CO_2Et$, $C_6H_4X·CO_2Me$, $C_6H_4X·CH_2·OAc$, and $C_6H_4X·OAc$. Consts. of the Arrhenius equation have been determined; for alkaline hydrolysis PZ is nearly const., the changes due to substituents being measured by ΔE. The relative influence of different substituents in a given series is fairly const. from one series to another, and the relative transmissibility of the electronic effect is fairly const. for different substituents, so that relative transmission coeffs. for different types of structure can be determined. In acid hydrolysis the influence of the substituents is smaller and less regular.   E. S. H.

Kinetics of neutralisation of pseudo-acids in water and deuterium oxide. S. H. MARON and V. K. LAMER (J. Amer. Chem. Soc., 1938, **60**, 2588—2596).—The rates of neutralisation of nitro-methane, -ethane, (I) and -isopropane (II) by OH' in H_2O and OD' in D_2O at 0° and 5° have been measured by a conductance method. The rate coeffs. in H_2O decrease in the above order; the rates for (I) and (II) in D_2O are 40% > in H_2O at the same temp. The rate coeffs. have been expressed as functions of temp., and energies and entropies of activation calc.
                    E. S. H.

Effect of the triple linking on the rate of reaction of ω-chlorides with potassium iodide in absolute acetone. M. J. MURRAY (J. Amer. Chem. Soc., 1938, **60**, 2662—2664).—The reaction velocities of Bu^aCl, $CPh\!:\!CCl$, $CPh\!:\!C·CH_2Cl$, $CPh\!:\!C·[CH_2]_2Cl$, $CPh\!:\!C·[CH_2]_3Cl$, $CHPh\!:\!CH·CH_2Cl$, and $CH_2\!:\!CH·CH_2Cl$

at 60° have been determined. Alternation in activity is observed throughout the acetylenic series; the activity of the most active acetylenic chloride is < that of the corresponding ethylenic compound.
E. S. H.

Mechanism of the aqueous hydrolysis of β-butyrolactone. A. R. OLSON and R. J. MILLER (J. Amer. Chem. Soc., 1938, **60**, 2687—2692).— β-Bromobutyric acid (I) has been resolved with morphine in MeOH; the mol. rotation $[M]_{5461}^{25}$ in acid solution is 116·5°; that of the Na salt is 106·6°. The rate of hydrolysis of optically active β-butyrolactone prepared from optically active (I) has been measured at different [H·]. The rates and the optical activity of the hydrolysis products show that the mechanisms of hydrolysis by H_2O, H′, and OH′ are distinct. The addition of an ion such as CO_3'' has a great influence on the H_2O and OH′ rates. The heats of activation for the reactions involved in the production of lactone from $CHBrMe \cdot CO_2'$ (II) and the racemisation of (I) by Br′ have been determined. The rate of the bimol. reaction between (II) and OH′ has been measured. The reaction between (II) and S_2O_3'' involves the unimol. formation of lactone as a primary step. E. S. H.

Kinetics and mechanism of α-amino*iso*butyronitrile formation. T. D. STEWART and C. LI (J. Amer. Chem. Soc., 1938, **60**, 2782—2787).—Sp. reaction rates for $CN \cdot CMe_2 \cdot OH + NHEt_2 \rightarrow CN \cdot CMe_2 \cdot NEt_2 + H_2O$ at 25° have been determined, using EtOH and $COMe_2$ as solvents. The rate laws deduced for the reactions in EtOH and $COMe_2$, respectively, are: $d(P)/dt = k'[COMe_2][amine]$ and $d(P)/dt = k''[amine][cyanohydrin]$. These are shown to be related by a common reaction mechanism.
E. S. H.

Kinetics of the periodate oxidation of αβ-glycols. C. C. PRICE and H. KROLL (J. Amer. Chem. Soc., 1938, **60**, 2762—2729).—Oxidation of $(CMe_2 \cdot OH)_2$ by $NaIO_4$ is a bimol. reaction, dependent on the concn. of $(CMe_2 \cdot OH)_2$ and of IO_4' and catalysed by acids or bases. $(CMe_2 \cdot OH)_2$ is oxidised faster than is $(CH_2 \cdot OH)_2$ in alkaline, but more slowly in acid, solution; alternative explanations are offered. R. S. C.

Kinetics of polymeric aldehydes. X. Course of reaction in the system polyoxymethylene-concentrated formaldehyde solution. J. LÖBE-RING (Z. Elektrochem., 1938, **44**, 781—790; cf. A., 1937, II, 399).—Mainly theoretical. The kinetics and mechanism of the process are considered in the light of previous work, and illustrated by reference to measurements with polyoxymethylene Me_2 ethers.
E. S. H.

Relative rate of ring-closure reactions. G. SALOMON (Trans. Faraday Soc., 1938, **34**, 1311—1320).—Published work is discussed (cf. A., 1936, 940; 1937, II, 88), with additional observations. The formation of 5- and 6-membered rings from halogenoalkylamines by the Menschutkin reaction can be observed in such different solvents as H_2O and C_6H_6. The variation of reaction rate with the halogenoalkylamine and the solvent is discussed. Using H_2O as solvent, ring-closure may occur simultaneously with hydrolysis, depending partly on the

length of chain. The general relations between chain length and ease of ring formation are discussed.
E. S. H.

Investigation of radium and barium precipitations using thorium-X as indicator. E. FÖYN, E. GLEDITSCH, and S. HANNEBORG (Mikrochim. Acta, 1938, **3**, 253—257).—A method for determining the rate of pptn. of Th-X in solutions containing SO_4'', in which the [Th-X] is found by measuring the thoron evolved, is described. The pptn.–time curves show that pptn. of Th-X requires a certain time depending on the concn. of SO_4'' and $BaCl_2$ added, and on the presence of foreign ions. The assumption that pptn. is immediate, and that in time the ppt. changes from a finely-cryst. condition with large emanating power to a coarsely-cryst. state with smaller emanating power, is disproved. An apparatus for measuring thoron content is described. It can be applied to the determination of Th in natural waters. L. S. T.

Amorphous and crystallised oxide hydrates and oxides. XLVII. Restriction of the " catalase " and " peroxidase " action of amorphous ferric hydroxide. A. KRAUSE [with Z. ALASZEW-SKA and A. SOBOTA] (Ber., 1938, **71**, [*B*], 2392—2398). —Investigation of the influence of various restricting agents on the peroxidase action and catalase action of röntgenographically amorphous Fe^{III} hydroxide (orthoferric hydroxide) in heterogeneous system shows that although the same OH group is present in both inorg. enzymes the " peroxidase " action is more readily poisoned than the " catalase " action. The latter is measured by the decomp. of H_2O_2, the former by the oxidation of HCO_2H by H_2O_2. The rate of oxidation is diminished as the concn. of HCO_2H increases. Dil. H_3PO_4, H_3PO_3, and H_2SO_4 are markedly, HNO_3 feebly, restrictive. The reaction, $2Fe^{···} + H_2O_2 \rightarrow 2Fe^{··} + 2H^· + O_2$, is not observed. Strong mineral acids at high concn. are destructive since they dissolve the catalyst and nullify the active OH. As compounds, particularly As_2O_3, are strongly and irreversibly restrictive. HCN distinctly restricts the peroxidase action whereas CO does not. The difference between peroxidase and catalase action is here particularly marked since the latter is not sensitive to I or KCN. KCN actually activates the decomp. of H_2O_2 since OH′ ions are formed as a consequence of hydrolysis. On the other hand the salts of heavy metals appear somewhat restrictive.
H. W.

Thermal dissociation of chromium trioxide. J. G. RISS and A. I. SELJANSKAJA (Acta Physicochim. U.R.S.S., 1938, **8**, 623—640).—The thermal decomp. of cryst. CrO_3 is a very slow process. At <180° decomp. of liquid CrO_3 is undetected even on prolonged heating; at 240°, however, the dissociation pressure is ~1 atm. The first decomp. product, Cr_5O_{13} ($Cr_2O_3,5·5CrO_3$), is produced in a unimol. reaction having activation energy of 33,970 g.-cal. and $\log_e k = -7427·55/T + 13·1248$. Other intermediate oxides, Cr_7O_{18} ($Cr_2O_3,5CrO_3$), Cr_8O_{21} ($Cr_2O_3,6CrO_3$), and Cr_5O_{12} ($Cr_2O_3,3CrO_3$), are formed. Cr_5O_{12} decomposes autocatalytically to Cr_2O_3 at 400°. Quartz and cast Fe have no significant catalytic activity; H_2SO_4

and $NaHSO_4$ increase the decomp. velocity very sharply owing to salt formation.   W. R. A.

Kinetics of reactions in heterogeneous systems (dissolution etc.). Application to the excretion of urea by the kidney. J. CLARENS and H. CLARENS (Bull Soc. chim., 1938, [v], **5**, 1516—1521).—The amount of substance dissolved or filtered in a given time is related to concn. by a curve which is linear over a certain range. This relation is discussed in general terms and with special reference to the excretion of $CO(NH_2)_2$.   E. S. H.

Commercial active charcoal. Influence of humidity on the velocity of adsorption of chloropicrin. R. LOISY (Bull. Soc. chim., 1938, [v], **5**, 1509—1516).—The rates of adsorption of $CCl_3 \cdot NO_2$ vapour (5 mg. per l.) in an air stream at 18° by three different steam-activated charcoals have been determined. The rates and the equilibrium concns. decrease with increasing $[H_2O]$ in the air stream.   E. S. H.

Rate of dissolution of iron, manganese, and ferromanganese in molten copper.—See B., 1938, 1432.

Influence of inorganic compounds on combustion of coal.—See B., 1938, 1379.

Catalytic effect of buffers on reaction $CO_2 + H_2O \rightleftharpoons H_2CO_3$. F. J. W. ROUGHTON and V. H. BOOTH (Biochem. J., 1938, **32**, 2049—2069).—The rates of CO_2 uptake of buffer solutions and of CO_2 output by HCO_3' solution suddenly mixed with buffer have been measured by an improved manometric technique. Buffers have a direct effect on CO_2 uptake other than removal of $H^\cdot$ in the ionisation $H_2CO_3 \rightarrow H^\cdot + HCO_3'$. The effect cannot be due to impurities or to " neutral salt " action but $\propto$ concn. of the more negative constituent of the buffer. Since similar catalytic coeffs. were obtained for these ions in buffers working at p_H 6—9, during CO_2 uptake and also CO_2 output, the effect must be catalytic. The buffers catalyse only $CO_2 + H_2O \rightleftharpoons H_2CO_3$ and not $CO_2 + OH' \rightleftharpoons HCO_3'$ and a mechanism for the catalysis is suggested. Straight-chain N bases do not act catalytically but combine with CO_2 giving carbamyl compounds. The effects of phosphate and cacodylate are additive but of carbonic anhydrase and phosphate are multiplicative. Biochemical implications are indicated.   F. H.

Catalytic action of tetra-ammonium salts. V. A. HOLZSCHMIDT and I. V. POTAPOV (Acta Physicochim. U.R.S.S., 1937, **7**, 778—790).—The kinetics of the reactions $NPhMe_2 + C_3H_5Br \rightarrow NPhMe_2(C_3H_5)Br$ (I), and $C_5H_5N + C_3H_5Br \rightarrow C_5H_5N(C_3H_5)Br$ (II), have been measured at 30°; measurements of (I) were made in solutions of MeOH and EtOH, and of (II) in MeOH. In both cases the " tetra-ammonium " salts formed act as catalysts for the reaction.   W. R. A.

Catalytic reaction between sodium nitrite and dichlorodiethylenediaminecobaltic chloride. J. P. McREYNOLDS and J. C. BAILAR, jun. (J. Amer. Chem. Soc., 1938, **60**, 2817—2818).—The reaction $[Co\ en_2Cl_2]^+ + 2NaNO_2 \rightarrow [Co\ en_2(NO_2)_2]^+ + 2NaCl$ is catalysed by traces of $Co^{\cdot\cdot}$. Evidence of the inter-

mediate formation of $Na_2Co(NO_2)_4$ is given and the mechanism discussed.   E. S. H.

Acid catalysis in non-aqueous solvents. VI. Racemisation of phenylmethylacetophenone and phenyl*iso*butylacetophenone in various solvents. R. P. BELL, O. M. LIDWELL, and J. WRIGHT (J.C.S., 1938, 1861—1865; cf. A., 1938, I, 258).—Reaction velocities have been determined at 100° for phenylmethylacetophenone in PhCl and phenyl*iso*butylacetophenone in anisole, $PhNO_2$, PhCl, and decahydronaphthalene in presence of acids. The results are similar to those reported for the inversion of menthone in PhCl (*loc. cit.*). A mechanism is suggested to explain the observed dependence of velocity on acid concn. The racemisation is catalysed by NEt_3 in PhCl in absence of acid.   E. S. H.

Kjeldahl determination of nitrogen.—See B., 1938, 1465.

Reactions in concentrated sulphuric acid. XII. Destruction of acetylene in the cold. J. MILBAUER (Chem. Obzor, 1938, **13**, 89—91, 118—120, 147—149, 163—165).—The reaction of C_2H_2 with H_2SO_4 is followed with a photo-cell since the colour of the solution changes from yellow to black with passage of the gas. Catalysts in order of decreasing activity are $HgSO_4$, SeO_2, $CuSO_4$, reduced V_2O_4, Ag_2SO_4, reduced MoO_3. As_2O_3 and SiO_2 are inactive, whilst Sb_2O_3, $PbSO_4$, HCl, $ZnSO_4$, SO_2, K_2SO_4, and especially $(NH_4)_2SO_4$ are inhibitors, the last keeping colourless for 6 hr. acid which with $HgSO_4$ would be instantly coloured, and neutralising the action of $HgSO_4$ present at the same time. Minute quantities of SO_2 or H_2O do not alter the reaction velocity, although at acid concn. $<95\%$ it falls considerably. The effect of a catalyst $\propto$ its concn. up to the saturation point, and reduces the time before coloration commences (with $HgSO_4$ to 0), which without a catalyst may be quite considerable. SeO_2 added to $HgSO_4$ does not give an enhanced catalytic effect as in kjehldahlisation.   F. R.

Sorption properties of mixed catalysts. II. Desorption of ammonia by the poisoning of ammonia-catalysts with oxygen-containing gases. N. M. MOROZOV and M. J. KAGAN (Acta Physicochim. U.R.S.S., 1938, **8**, 549—564; cf. A., 1937, I, 76).—The abundant liberation of NH_3 by poisoning of NH_3 catalysts with O_2-containing gases in presence of H_2 is due to acceleration of the reduction of the N_2 adsorbed on the surface of the catalyst. The rate of reduction for catalyst $Fe + Al_2O_3 + K_2O$ (I) is $>$ that for $Fe + Al_2O_3$ (II), but the total amount of N_2 reduced is greater for (II) than for (I).   W. R. A.

Catalytic action of various kinds of ferric hydroxide in presence of promoters. O. BELFIORI (Gazzetta, 1938, **68**, 405—411).—The oxidation of HCO_2H with H_2O_2 catalysed by $Fe(OH)_3$ is strongly promoted by small amounts of Cu, but not of Mn, Ni, Co, or Zn. The promoter action of Cu has been studied using various preps. of $Fe(OH)_3$.   O. J. W.

Phosphoric oxide as catalyst of the polymerisation of olefines.—See A., 1939, II, 3.

Catalyst poisoning from the viewpoint of the specificity of active centres. VI. Temperature-

dependence of the relative duration of stay of water and ethyl alcohol molecules on copper. A. BORK. VII. Kinetics of the dehydration of ethyl alcohol on aluminium oxide. VIII. Orientation of the molecules of the aliphatic alcohols $C_nH_{2n+2}O$ in the dehydration of the alcohols on aluminium oxide. IX. Influence of methyl substituents on the activation energy of the dehydration of the aliphatic alcohols $C_nH_{2n+2}O$ on aluminium oxide. A. BORK and A. A. TOL-STOPJATOVA (Acta Physicochim. U.R.S.S., 1937, 7, 745—748; 1938, 8, 577—590, 591—602, 603—616; cf. A., 1937, I, 573).—VI. The temp.-independence of the relative stay of the H_2O mol., with the active Cu surface at temp. 240—266·5°, has been experimentally demonstrated.

VII. The dehydration of EtOH by Al_2O_3 obeys the equation previously obtained for the dehydrogenation of EtOH (A., 1936, I, 1472). The ratio α_2/α_1 of the adsorption coeffs. of H_2O to that of EtOH at 350° is 0·65.

VIII. The dehydration of both Pr^aOH and $Pr^\beta OH$ also follows the same equation. α_2/α_1 for Pr^aOH and $Pr^\beta OH$ is identical with that for EtOH and thus, presumably, the orientation of the mols. of the different alcohols on the surface of the catalyst is similar.

IX. The influence of Me substituents on the activation energy of the dehydration of 6 aliphatic alcohols has been experimentally investigated. W. R. A.

Catalytic properties of the phthalocyanines. I. Catalase properties. II. Oxidase properties. IV. Chemiluminescent reactions. A. H. COOK (J.C.S., 1938, 1761—1768, 1768—1774, 1845—1847; cf. A., 1939, II, 25).—I. The catalytic effect of metal phthalocyanine pigments on the decomp. of H_2O_2 has been investigated; that of Fe pigments is outstanding. The influence of p_H, poisons, etc. has been examined, and the results are compared with those for Fe porphyrins.

II. $Fe^{..}$ and $Fe^{...}$ phthalocyanines, Fe octatetrazaporphine, and to a limited extent a H_2O-sol. monosulphonated Fe phthalocyanine are outstanding in their ability to catalyse oxidations by O_2. Typical oxidations have been observed qualitatively, and the catalysed oxidation of PhCHO has been studied quantitatively. The results are discussed with special reference to biochemical reactions.

IV. Fe pigments of the phthalocyanine type catalyse the chemiluminescent oxidation of luminol by H_2O_2 or O_2. The oxidation of fluorescent phthalocyanines of metals of group II and also of chlorophyll by org. peroxides at elevated temp. is usually accompanied by emission of red light. E. S. H.

Chromium oxide deposit on magnesium. R. DELAVAULT (Bull. Soc. chim., 1938, [v], 5, 1522—1523).—The formation of the protective oxide film, acquired by Mg when immersed in aq. $K_2Cr_2O_7$, is catalysed by SO_4'' and S_2O_8''. E. S. H.

Production of oxidic catalysts by separation of aerosols. I. Catalytic activity of separated aerosols of copper oxide. P. BESSALOV and N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1937, 7, 649—666).—The catalytic activities of CuO aerosol

(I) from 30° to 400°, and of CuO powder (II) from 150° to 400°, have been investigated for the oxidation of CO to CO_2. The catalytic activity of both becomes apparent around 200°. Comparison of the observed velocity coeffs. with those calc. by the Arrhenius equation shows that this equation is valid for (I) but not for (II). The relative activity of (I) increases with temp., and at 250° is 765 times that of (II). X-Ray photographs of the catalysts before and after the reaction show that, although their structure is unchanged, the crystal size of (I) has been diminished considerably, and this is confirmed by photomicrographic tests. (I) adsorbs twice as much air as (II) at the temp. of liquid air. W. R. A.

Aerogel catalysts.—See B., 1938, 1388.

Phosphatatic actions of hydrogels. II. Behaviour of metallic hydroxides towards phosphoric esters. IV. Catalytic fission of pyro- and poly-phosphates. E. BAMANN and M. MEISENHEIMER (Ber., 1938, 71, [B], 1980—1983, 2233—2236; cf. A., 1938, I, 629).—II. Hydrolysis of phosphoric esters is accelerated by the hydroxides of Ce, Pr, Nd, Sm, Er, Y, Zr, Th, Pb (slightly), and Mn, whereas those of Be, Mg, Ca, Zn, Cd, Al, Bi, Cu, and Sb are ineffective.

IV. In the conversion of $H_4P_2O_7$ into H_3PO_4 the hydroxides of La, Ce, Zr, and Th are very active, those of Y, Pb, and Mn have medium activity, whereas little activity is shown by those of Mg, Zn, Al, and Fe. $H_5P_3O_{10}$ is rapidly converted into H_3PO_4 by the hydroxides of La and Y, readily by those of Mn and Fe, and less easily by those of Al and Zn. Under identical conditions $La(OH)_3$ causes 14%, 14%, 8%, and 4% conversions of $(NaPO_3)_3$, $Na_5P_3O_{10}$, $Na_4P_2O_7$, and Na glycero-β-phosphate in equal intervals of time. Esters of $H_4P_2O_7$ are converted into H_3PO_4 by suitable gels. H. W.

Dehydration of hydrated magnesium chloride. I. Mutual relation between potassium and sodium chlorides as addition agents. S. IMATOMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1364—1376).—Experiments on the dehydration of $MgCl_2,6H_2O$ with KCl-NaCl mixtures as addition agents are described. A relation $y = ax$ between x, the decrease in the "addition rate" of KCl, and y, the "addition rate" of NaCl which is needed for the decrease x to keep the amount of MgO formed const., is indicated. a is a numerical coeff. dependent on the temp. of the dehydration; for the production of Mg electrolyte it is 3. The significance of this equation is discussed from the industrial viewpoint.
W. R. A.

Rôle of catalysts in formation of phenol-formaldehyde condensation products.—See B., 1938, 1450.

Rôle of catalysts in textile chemistry.—See B., 1938, 1402.

Gas development at a graphite electrode after opening the circuit. V. SIHVONEN and P. SAR-KAMIES (Suomen Kem., 1938, 11, B, 19—21; cf. A., 1937, I, 573).—From the amount of gas held in a graphite electrode during electrolysis at various c.d. it is deduced that the evolution of H_2 and O_2

from graphite electrodes follows approx. a second-order equation, so long as the graphite surface is only slightly charged with gas and hence the discharge of ions is the velocity-determining reaction. By measuring the vol. of gas evolved at various periods after interruption of the current it is found that the evolution of H_2 follows a second-order equation in NaOH but a third-order equation in H_2SO_4, whilst the evolution of O_2 follows a first-order equation in NaOH or in H_2SO_4 at low c.d., but a second-order equation after a higher c.d. has been employed. These results are discussed with reference to the various forms in which the gases may be adsorbed.

J. W. S.

Electrolysis of magnesium chloride hexahydrate and -alcoholate in methyl and ethyl alcohol. (MLLE.) M. L. QUINET (Bull. Soc. chim., 1938, [v], 5, 1568—1572).—Saturated solutions of $MgCl_2$ in MeOH or EtOH yield $MgCl_2,3Mg(OMe)_2$ or $MgCl_2,3Mg(OEt)_2$ at the cathode. Solutions of $MgCl_2,6H_2O$ in the same solvents deposit $[Mg(H_2O)_6]^{..}$, which reacts with the alcohol forming a white ppt., $Mg(OR)_2,(H_2O)_6$, which slowly decomposes: $Mg(OR)_2,(H_2O)_6 \rightarrow Mg(OH)_2 + 2ROH + 4H_2O$.

E. S. H.

Electrochemistry of niobium. G. GRUBE and H. L. GRUBE (Z. Elektrochem., 1938, 44, 771—780).—Aq. Nb^V in HCl is reduced at Pt or Hg cathodes to a bluish solution, which on titration with $KMnO_4$ is shown to contain Nb^{III}. The solutions evolve H_2 in contact with Pt, but potential measurements have been made with Hg electrodes. The normal potential of the process, $Nb^{...} + H_2O \rightleftharpoons NbO^{...} + 2H^. + 2e$, at room temp. is $- 0.344 \pm 0.002$ v. in HCl and -0.342 ± 0.001 v. in H_2SO_4.

E. S. H.

Determination of cathode current density in connexion with the structure of electrolytic metal deposits. A. T. WAHRAMIAN (Acta Physicochim. U.R.S.S., 1937, 7, 683—690).—Theoretical considerations indicate that an accurate calculation of the cathode surface actually participating in electrolysis explains the effect of the change of current strength in cells on the structure of the cathode deposit. Calculation of the thickness of the newly-formed layers in conjunction with the theory of cathode passivity explains the shape of the crystals formed, and their deformation.

W. R. A.

Stannous ammonium oxalate electroplating bath.—See B., 1938, 1440.

Electrodeposition of tin.—See B., 1938, 1440.

Electrodeposition of lead on base metals.—See B., 1938, 1440.

Electrodeposition of manganese.—See B., 1938, 1440.

Kolbe's synthesis in the electrolysis of butyric acid. E. DENINA (Gazzetta, 1938, 68, 443—458).—The conductivity of solutions of $PrCO_2H$ and of $PrCO_2Na$ has been determined. In the electrolysis of $PrCO_2Na$ solutions with smooth Pt electrodes the Kolbe synthesis commences at an anode potential of 2.18 v. Under the best conditions found the current efficiency for the formation of C_6H_{14} is 40%.

C_3H_6 is formed simultaneously with a current efficiency of about 40%.

O. J. W.

Surrounding gaseous medium and the Herschel effect. M. THURSTON and J. M. BLAIR (J. Opt. Soc. Amer., 1938, 28, 348).—Measurements of the rate of the Herschel effect have been made with various photographic emulsions in atm. of H_2, O_2, or air. Contrary to the results obtained by Vnukova (A., 1937, I, 626) with Russian diapositive plates, the effect was independent of the gas.

J. A. K.

Action of light on bismuth carbonate. N. GLASS (Quart. J. Pharm., 1938, 11, 468—477).—The purer is the sample the greater is the darkening on exposure to light in the presence of sugars. The cause of light-sensitivity has been investigated.

P. G. M.

Primary process in the photodecomposition of aldehydes and ketones. E. GORIN (Acta Physicochim. U.R.S.S., 1938, 8, 513—515).—To prove the presence or absence of the Norrish type of reaction in the photodecomp. of $COMe_2$, MeCHO, CH_2O, and COMeEt, and to determine the no. of free radicals produced per quantum of light absorbed, the free radicals formed were fixed by means of I vapour. In all cases the no. of free radicals formed is independent of temp., the pressure of I, and the aldehyde or ketone. With $COMe_2$ the no. of Me radicals formed per quantum absorbed is 1. The Ac radicals react incompletely with I, the remainder recombining to give Ac_2. Above 100°, CO is formed according to $COMe \rightarrow Me + CO$ (min. activation energy 20 kg.-cal.). The primary process over the photochemically active spectrum is $COMe_2 + h\nu \rightarrow Me + COMe$. With MeCHO two primary reactions $h\nu + MeCHO \rightarrow CH_4 + CO$ or $Me + CHO$ occur; $\not< 90\%$ of the CHO react: $CHO + CHO = CH_2O + CO$. In absence of I, $\not< 85\%$ of the Me and CHO radicals recombine to form MeCHO. With CH_2O the primary process at 3130 and 2536 A. is $CH_2O + h\nu \rightarrow H + CHO$, and at 3650 A., $CH_2O + h\nu \rightarrow H + CHO$ and $H_2 + CO$. With COMeEt the primary process at 3130 A. is almost completely $COMeEt \rightarrow Et$ (or Me) $+ COMe$ (or COEt). In unfiltered light several % of the reaction $COMeEt \rightarrow C_3H_5 + CO$ occurs. L. S. T.

Effect of atomic hydrogen on synthesis of ammonia under positive-ion impact. A. GELBART and I. MOCHAN (Acta Physicochim. U.R.S.S., 1937, 7, 767—777).—Using artificial spodumene samples as source of positive ions, the synthesis of NH_3 under positive-ion impact has been investigated. The absence of proportionality between the ionic current and the yield of NH_3 has been substantiated. With additional generation of at. H on a glowing W filament the reaction rate increases with the ionic current. The yield per ion in the latter case is independent of the ionic current, and lies between 0.1 and 0.3. This indicates that the synthesis of NH_3 depends on the presence of activated N and H atoms. Various possible mechanisms are considered; the reaction is believed to proceed on a cooled wall where an adsorbed layer of at. H is available. W. R. A.

Interaction between methylene radicals and hydrogen.—See A., 1939, II, 6.

General and inorganic chemistry of deuterium. I—IV. E. EINECKE (Österr. Chem.-Ztg., 1938, **41**, 331—340, 355—359, 371—376, 395—400).—I. The discovery, isolation, and physical properties of D_2 are summarised. The reactions of D atoms and of D_2 mols. are discussed and compared with the corresponding reactions of H and H_2.

II. The methods of prep. of compounds of D with H, C, N, P, As, O, S, Se, and halogens, and of ND_4 halides are described. The physical properties of these compounds, so far as known, are tabulated and compared with those of the corresponding H compounds.

III. The concn. of D_2O by electrolysis of aq. NaOH using various forms of electrode, and the relative concns. of D_2O in various natural sources of H_2O, are discussed. The physical properties of D_2O and H_2O are compared. The methods of determining D_2 in H_2 are described.

IV. The differences in reaction velocity in D_2O and H_2O, due to the physical properties of the solvent, to interaction of the solvent with the reactants, and through differences in ionisation, are discussed. The dissociation consts. of various electrolytes in D_2O are compared with those in H_2O. The ease of replacement of H by D, and vice versa, in various inorg. and org. mols. are discussed in relation to the various types of linkage involved.　　　J. W. S.

Bi- and ter-valent silver compounds. W. LIMANOWSKI (Rocz. Chem., 1938, **18**, 228—233).—The black ppt. obtained by the action of S_2O_8'' on $Ag\cdot$ contains Ag^{III} and Ag^{II} in equal amounts. After 7 days at room temp., under H_2O, the ppt. contains only Ag^{II}, which does not change further during 12 months.　　　R. T.

Reactions in the solid state at high temperatures. XXI. Formation of magnesium titanates from the oxides in the solid state. W. JANDER and K. BUNDE (Z. anorg. Chem., 1938, **239**, 418—426).—When MgO and TiO_2 are heated together at 850—1090° in any proportions the first product is $MgTiO_3$. When TiO_2 is in excess the subsequent formation of $MgTi_2O_5$ is fairly rapid, whereas with excess of MgO the formation of Mg_2TiO_4 is much slower.　　　F. J. G.

Deleterious effects of corrosive waters on zinc. —See B., 1938, 1512.

Lower hydrates of lanthanum and praseodymium nitrates. J. N. FRIEND and D. A. HALL (J.C.S., 1938, 1920—1921).—The residue obtained when $La(NO_3)_3,6H_2O$ is exposed over conc. H_2SO_4 for some years is $La(NO_3)_3,H_2O$. In similar circumstances $Pr(NO_3)_3,6H_2O$ yields $Pr(NO_3)_3,2H_2O$.　　　E. S. H.

Oxidation of carbon at atmospheric pressure. V. SIHVONEN and J. JÄRVINEN (Suomen Kem., 1938, **11**, B, 27—28).—When heated in a stream of O_2 at 900—1200° diamonds yield exclusively CO_2, but graphite gives some CO as well. Attack on the diamond leads to etching along the cleavage planes. Diamonds burn readily at a white heat. Diamonds are much more resistant than graphite to attack by H_2O vapour or CO at 900—1200°, but oxidation leads to

non-oriented pitting of the crystal. In H_2O both CO and CO_2 are formed, the latter being attributed to secondary reaction of the primarily formed CO with H_2O. When graphite is heated in H_2O vapour both CO and CO_2 seem to be formed as primary products. The results are discussed with reference to the difference in degree of unsaturation of the surface atoms in diamond and graphite and Sihvonen's views of the mechanism of oxidation of C.　　　J. W. S.

Attempted exchange of phosphorus between phosphorous and phosphoric acids. J. N. WILSON (J. Amer. Chem. Soc., 1938, **60**, 2697—2699).—No exchange in acid or alkaline solution could be detected by the radioactivity method. If the P atoms in $H_4P_2O_6$ are equiv., the equilibrium const. $K = [H_4P_2O_6]/[H_3PO_4][H_3PO_3] = <8 \times 10^{-5}$ mol.$^{-1}$ l. at 25° in 5·6 formal HCl.　　　E. S. H.

Tantalum iodides. F. KÖRÖSY (Tech. Kurir, 1938, **9**, 81—83).—TaI_5, formed when Ta is brought into contact with an excess of I vapour, is a brownish-black microcryst. powder, m.p. 365°, d^{150} 4·68; electrical conductivity $<10^8$ Ω in the cold, 7×10^6 Ω at 100°. TaI_5 hydrolyses rapidly : $2TaI_5 + 5H_2O = 2Ta(OH)_5 + 10HI$. In the atm. traces of I are formed. With O_2 it reacts quantitatively at 100° ; at higher temp. the reaction is very vigorous : $4TaI_5 + 5O_2 = 2Ta_2O_5 + 20I$. With H_2 at 450° for several hr. TaI_5 does not react. On dissolution in H_2SO_4, I is formed, and on dilution tantalic acid is pptd. CCl_4, $CHCl_3$, CS_2, C_6H_6, PhMe, and C_5H_{12} do not dissolve TaI_5. With EtOH, PrOH, glycerol, C_5H_5N, and NH_2Ph TaI_5 forms a white ppt., whilst the solution becomes yellow owing to traces of I. TaI_5 decomposes, but yields a clear solution, in Ac_2O and BuOAc. It reacts at high temp. with Ta, yielding a mixture of Ta, TaI_5, and possibly TaI_3.　　　E. P.

Stable sulphur dithiocyanate. P. A. BOND and G. A. WEAVER, jun. (J. Amer. Chem. Soc., 1938, **60**, 2614—2615).—$S(SCN)_2$, prepared by the action of S_2Cl_2 on metallic thiocyanates, is stable below 500—600°.　　　E. S. H.

Preparation of molybdate-orange.—See B., 1938, 1451.

Reduction of tungstic oxide with solid carbon and hydrogen. W. BAUKLOH and F. JAEGER (Z. anorg. Chem., 1938, **239**, 365—368).—Reduction of W_4O_{11} by solid C begins at 800° and is complete in 8 hr. at 950°. In presence of Fe the reduction begins at 700° and is complete in 8 hr. at 850°. With H_2 reduction begins at 450° and is complete in 1 hr. at 700°, these temp. being < those given by earlier workers as a result of the use of a rapid stream of very dry H_2 ; in presence of Fe the reaction begins at 400° and is complete in 2 hr. at 600°. The product of reduction below 600° is pyrophoric.　　　F. J. G.

Residual affinity and co-ordination. XL. Complex compounds of rhenium. (SIR) G. T. MORGAN and G. R. DAVIS (J.C.S., 1938, 1858—1861).—$K_2Na[ReO_2(CN)_4],6H_2O$ has been prepared from K_2ReO_4, KCN, and N_2H_4,H_2O ; by similar methods $Na_3[ReO_2(CN)_4],2H_2O$ and $K_3[ReO_2(CN)_4]$ (I) have been obtained. From 9-ω-phenanthridylmethyl-N-pyridinium chloride and (I) in H_2O the product is

$(C_{19}H_{15}N_2H)_3[ReO_2(CN)_4],4H_2O$; similarly, in 0·5N-HCl $(C_{13}H_9NH)_3[ReO_2(CN)_4],2H_2O$ (II) and $(C_{10}H_8N_2H_2)_3[ReO_2(CN)_4],3H_2O$ are obtained from phenanthridine and 2 : 2'-dipyridyl, respectively. (II) yields $(C_{13}H_9NH)_2H[ReO_2(CN)_4]$ when dissolved in hot 4N-HCl and crystallised out. K_2ReCl_6 reacts with 2 : 2'-dipyridyl in very dil. HCl yielding $(C_{10}H_8N_2H)_2ReCl_6$; in 4N-HCl the product is $(C_{10}H_8N_2H_2)ReCl_6$; with 2 : 2' : 2''-tripyridyl the product is $(C_{15}H_{11}N_3H_2)ReCl_6,H_2O$ independently of [HCl]. H_2ReO_4 reacts with 2 : 2'-dipyridyl and 2 : 2' : 2''-tripyridyl in dil. AcOH yielding $(C_{10}H_8N_2H)ReO_4$ and $(C_{15}H_{11}N_3H)ReO_4$, respectively. Properties of the above compounds are described. The Re content of Australian molybdenite is about 1 p.p.m.   E. S. H.

Production of different magnetic substances from FeOOH. R. FORRER (Compt. rend., 1938, **207**, 670—671).—Four products are described. (A), obtained by rapid heating, is non-ferromagnetic. (B), obtained by slow heating, exhibits ferromagnetism at 250—275° (⊖ 350°); at >275° this gives a second ferromagnetic form, (C) (⊖ 520°). Prolonged heating at ~600° gives non-ferromagnetic (D). (A), (C) and (D) have an α-Fe_2O_3 lattice, and (A) and (D) are probably identical. (B) contains a γ-Fe_2O_3 lattice.   A. J. E. W.

Amorphous and crystallised oxide-hydrates and oxides. XLVIII. Activity of iron rust. A. KRAUSE and A. LEWANDOWSKI (Z. anorg. Chem., 1938, **239**, 395—398).—Ordinary Fe rust reacts with Ag_2O gel affording $AgFeO_2$. The catalytic activity of rust in the rusting process is connected with the presence of " active " H atoms in γ-FeO·OH.   F. J. G.

Tables for derivation of p_H, using the quin-hydrone electrode. A. M. KASCHPUR (Ukrain. Biochem. J., 1938, **11**, 449—463).   R. T.

Application of conductometric titration to acidimetry. M. I. LAPSCHIN (Zavod. Lab., 1938, **7**, 479—481).—Conductometric titration is preferred for titration of mixtures of strong and weak acids, of salts of weak acids with strong bases, or vice versa, and of coloured or turbid solutions.   R. T.

Potassium hydrogen phthalate as a buffer for use with the hydrogen electrode. J. RUSSELL and R. E. STAUFFER (J. Amer. Chem. Soc., 1938, **60**, 2820—2821).—0·05M-K H phthalate is satisfactory for temp. as high as 40°.   E. S. H.

Application of sodium phenolphthaleinate to volumetric microanalysis. L. M. KULBERG (Zavod. Lab., 1938, **7**, 417—421).—A solution of phenol-phthalein in 20% Na_2CO_3 is evaporated to dryness, the residue is extracted with EtOH, the extract is evaporated to dryness, the residue is again extracted, and the final extract is evaporated, to yield pure Na phenolphthaleinate, solutions of which serve for the titration of acids the P_8 of which <7·96.   R. T.

Acidimetric titration of coloured solutions. R. C. BURSCHTEIN and T. V. GATOVSKAJA (Zavod. Lab., 1938, **7**, 345—346).—Titration of a no. of coloured solutions in presence of fluorescein (A., 1938,

II, 210) gives results in good agreement with those obtained electrometrically.   R. T.

Determination of dissolved water in liquefied gases.—See B., 1938, 1410.

Ammonium chloride–sodium sulphide solutions for organic nitro-reductions and for inorganic qualitative analysis. M. J. MURRAY and D. E. WATERS (J. Amer. Chem. Soc., 1938, **60**, 2818—2819).—Reductions are performed with good yields by adding the mixture to the NO_2-derivative dissolved in aq. NH_3 or EtOH + aq. NH_3. Conc. NH_4 polysulphide for qual. analysis is conveniently prepared by adding S to the above mixture.   E. S. H.

Photo-nephelometric determination of chloride in chromate and dichromate reagents. L. E. SABININA and L. I. ROZENGARD (Zavod. Lab., 1938, **7**, 727—729).—Small amounts of chloride are determined by a photo-nephelometric method.   R. T.

Pontius' chlorometric method. M. CHAMBON (Bull. Soc. chim., 1938, [v], **5**, 1458—1463).—The mechanism of reaction between CaCl·OCl and KI in presence of $NaHCO_3$ at p_H 8—9 is discussed. Observations recorded point to the intermediate formation of I, according to (a) $HOCl + 2KI \rightarrow 2I + KCl + KOH$, and (b) $5OCl' + 2I + H_2O \rightarrow 2IO_3' + 5Cl' + 2H'$.   E. S. H.

Analytical notes. I. C. W. DAVIES (Canad. J. Res., 1938, **16**, B, 227—229).—(1) Org. compounds containing Se or Hg can be decomposed without loss of Se or Hg by means of " nitro–chlorate " mixture before determining the Se or Hg gravimetrically. (2) Solutions containing unknown amounts of Cl' and Br' are treated with a known excess of $AgNO_3$. From the wt. of the ppt. and the wt. of the Ag in it, the amounts of Cl and Br can be calc. (3) By the addition of 2 g. of powdered $Ca(OAc)_2$ to 20—30 g. of soya-bean oil before ignition, the P in the oil is retained as $Ca_3(PO_4)_2$.   C. R. H.

Potentiometric determination of small amounts of bromide. S. K. AFANASIEV, M. A. PORTNOV, and J. N. TSCHEPELKIN (Zavod. Lab., 1938, **7**, 547—550).—Tschirkov's method (A., 1935, 316) gives satisfactory results for determination of Br' in Karabugaz saline, on condition that empirical corrections are applied for reaction of other constituents with NaOCl, and for the Br content of the latter reagent.   R. T.

Colorimetric determination of bromides in presence of chlorides. A. V. VINOGRADOV (Zavod. Lab., 1938, **7**, 426—428).—In Sweeney and Withrow's method (A., 1917, ii, 423) the coloration rises to a max., and then falls, as the vol. of aq. Cl_2 added is increased; this is due to formation of BrCl. The following modification is proposed : the amount of 0·05N-$KBrO_3$ giving max. coloration in a series of 8 test-tubes each containing 3 ml. of solution (≮0·6 mg. Br'), 0·3 ml. of 10N-H_2SO_4, and 3 ml. of CCl_4 is determined, and this ratio is applied in the colorimetric determination of Br' by the above method, substituting $KBrO_3$ for Cl_2. I' does not interfere if [I']/[Br'] ≯0·3.   R. T.

**Titration with adsorption indicator. Argento-metry of strongly acidic solution of halide with

metanil-yellow, and its mechanism of adsorption. Y. MIYAKE (J. Chem. Soc. Japan, 1936, **57**, 277—284).—By utilising the amphoteric property of metanil-yellow, the end-point of the titration of Br′ or I′ by $0.1N$-$AgNO_3$ in acid solution can be easily detected. CH. ABS. (e)

Determination of iodine in drinking water, urine, and substances containing only about 1000 times as much organic matter as iodine. A. C. BRATTON and J. F. McCLENDON [with W. FOSTER and R. WHITE] (Ind. Eng. Chem. [Anal.], 1938, **10**, 600—605).—The material is fused with $NaOH$ in presence of rare-earth oxides as catalysts. $IO_3′$ is reduced and $NO_2′$ is destroyed by addition of Na_3N. The I from oxidation of I′ by $Fe^{...}$ in acid solution is distilled into aq. Br which oxidises it to $IO_3′$. Excess of Br is blown out by means of air at 100°, and after addition of KI the I is titrated electrometrically by means of $0.001N$-$Na_2S_2O_3$. The method is applicable to samples containing only mg. amounts of org. matter, Cl′, and silicates, and < 0.2 μg. of I. It is thus applicable to drinking-water and soil solution provided that [Cl′] is > 0.5 millimol., to urine, thyroid gland, seaweed, etc. It is not applicable to sea-water, brine, and some mineral waters, or to soil samples. L. S. T.

Methyl-red as an indicator in titration of fluorides by thorium salts. (A) I. V. ILJIN. (B) V. A. ZACHAREVSKI (Zavod. Lab., 1938, **7**, 637, 637—638).—A criticism of Zacharevski (A., 1938, I, 211), and a reply. R. T.

Test of suitability of pyrogallol solutions [for absorption of oxygen]. A. V. MAZOV (Zavod. Lab., 1938, **7**, 359—360).—The no. of times a given vol. of air has to be passed through the pyrogallol absorption bulb of an Orsat apparatus for full absorption of O_2 rises from 5 for fresh solution to 7 for a solution which has absorbed 20 c.c. of O_2 per g.-mol., and to 9 for one containing 30 c.c. of O_2. Solutions not giving full absorption after 5 passages should be replaced. R. T.

Determination of dissolved oxygen by means of the dropping mercury electrode, with applications in biology. H. G. PETERING and F. DANIELS (J. Amer. Chem. Soc., 1938, **60**, 2796—2802).—The modified polarographic procedure described is particularly suited to systems which involve changing $[O_2]$. Applications to the photosynthesis and respiration of algæ, and the respiration of yeast and blood cells, are described. E. S. H.

Bromatometric determination of thiocyanate. L. SZEBELLÉDY and W. MADIS (Z. anal. Chem., 1938, **114**, 343—346).—The neutral CNS′ solution is diluted to 35 c.c., and 3 g. of NaBr, 15 c.c. of 2N-HCl, and 5 mg. of Fe^{III} alum are added. $0.1N$-$KBrO_3$ is added to the red coloured solution until the colour is discharged. 1 c.c. of 0.1% $AuCl_3$ solution is added and, after 30 sec., the titration is completed dropwise until a permanent yellow colour, matching that of a comparison solution, is obtained. The reaction between CNS′ and Br is slower in aq. H_2SO_4 than in aq. HCl. The results agree with those obtained by the Volhard method. L. S. T.

Use of Trautz's micro-Dumas method [for determining nitrogen] with the apparatus of Pregl. C. W. BEAZLEY (Ind. Eng. Chem. [Anal.], 1938, **10**, 605).—Trautz's method (A., 1931, 752, 971) can be used with a slightly modified Pregl apparatus and is widely applicable. Typical results are given, and the necessary modifications described. A complete analysis requires 30 min. L. S. T.

Colorimetric determination of oxides of nitrogen. I. N. KUZMINICH and E. J. TURCHAN (Zavod. Lab., 1938, **7**, 635—636).—Polemical, against Varlamov (A., 1938, I, 211). R. T.

Determination of nitrite in waters.—See B., 1938, 1512.

Rapid determination of phosphorus in steel.—See B., 1938, 1431.

Drop method of approximate determination of phosphoric acid. G. T. MICHALTSCHISCHIN (Bull. Sci. Univ. Kiev, 1937, **3**, No. 3, 79—84).—The solution is evaporated to dryness with HCl, and the residue is heated with 0.5 ml. of conc. H_2SO_4 to evolution of SO_3. 4—6 ml. of H_2O and a few drops of H_2O_2 are added to the cooled residue, and the solution is boiled and filtered. The filtrate + washings are made up to 25 ml., and a drop is placed on a spot of aq. $(NH_4)_2MoO_4$ on filter-paper; the spot is dried, and a drop of benzidine solution is placed on it. The coloration developing after exposure to NH_3 is compared with that given by a series of standard solutions. 0.1—0.5 mg. of P_2O_5 may so be determined, with an error of 0—20%, in presence of all the ordinary anions. R. T.

Reaction of metaphosphoric acid with basic triphenylmethane dyes. H. HERRMANN (Mikrochim. Acta, 1938, **3**, 193—196).—Aq. HPO_3 gives with aq. crystal-violet (I) dark blue, rod-shaped crystals, limiting sensitivity 3 μg.; fuchsin gives a brownish-green fluorescence and a ppt., sensitivity 10 μg.; Victoria-blue, a greenish fluorescence, and an amorphous ppt., sensitivity 10 μg. Malachite-green and Me-green give no reaction. The crystals obtained with (I) are readily sol. in N-HCl, sparingly sol. in H_2O, and insol. in light petroleum, C_6H_6, PhMe, and xylene. Their analysis corresponds with $3HPO_3,2(I),8H_2O$. H_3PO_4 gives none of the above reactions. L. S. T.

Determination of arsenic with the use of amalgamated aluminium in place of zinc. M. P. BOLOTOV (Vopro. Pitaniya, 1934, **3**, No. 4, 1—17).—Zn may be replaced by amalgamated Al in the determination of As as AsH_3. CH. ABS. (e)

Determination of boron in cast iron and steel.—See B., 1938, 1425.

Detection of boric acid in [natural] waters by the curcumin reaction. J. NĚMEJC (Chem. Listy, 1938, **32**, 340—345, 361—364).—$NO_2′$, $NO_3′$, I′, Br′, K·, $NH_4·$, $SO_4″$, Ca··, and Mg·· may interfere with detection of H_3BO_3 in H_2O by the curcumin reaction. The first four ions are eliminated by evaporation in presence of H_3PO_4, and $SO_4″$ is pptd. as $BaSO_4$; the [K·] and [$NH_4·$] of natural H_2O are too low to interfere. Ca and Mg are pptd. as phosphates by

adding 2·1 c.c. of 2·6% Na_2HPO_4 in 1·54% $NaHCO_3$ to 30 c.c. of the H_2O, and boiling. The final solution is tested for H_3BO_3 in the usual way with curcumin paper ($\pm$0·3 µg. of H_3BO_3).   R. T.

Reducing the evaporation time in the determination of silicon by the Otis–Handy method. H. FUCHSHUBER (Chem.-Ztg., 1938, **62**, 743).—The method is modified to avoid spurting during evaporation by adding to the acid solution, after dissolution of the silumin, small amounts of 96% EtOH until foaming ceases, and then 10 c.c. in excess. The covered beaker is heated on a hot plate at 250—300°. The solution forms a jelly and then a blistery mass which is easily broken by a glass rod.   I. C. R.

Determination of carbon in iron and steels.—See B., 1938, 1431.

Determination of carbon monoxide in gas and air.—See B., 1938, 1410.

Baryta method of determining small amounts of carbonates. G. N. EVETSKI and E. I. ZLOBIN-SKAJA (Zavod. Lab., 1938, **7**, 484—486).—CO_2-free air is aspirated through the boiling acidified carbonate solution, and the CO_2 evolved is absorbed by 0·1N-$Ba(OH)_2$, excess of which is titrated with 0·1N-HCl.   R. T.

Standard method of determination of potassium. V. M. TICHOMIROV (Zavod. Lab., 1938, **7**, 729).—In the industrial method of determination of K as $KClO_4$, one evaporation to dryness is sufficient to remove NH_4Cl, in place of three ordinarily applied.   R. T.

Rapid separate determination of potassium and sodium. II. Determination of sodium. M. A. PORTNOV and S. K. AFANASIEV (Zavod. Lab., 1938, **7**, 421—425; cf. A., 1938, I, 269).—K is pptd. with Mg dipicrylamine, and Na is determined polarographically in the filtrate, applying a correction for the residual [K·] = $0·98 \times 10^{-3} + 0·0747(t - 10)10^{-3}$.   R. T.

Polarographic method as applied to chemical analysis of metals.—See B., 1938, 1437.

Bromatometric determination of calcium. L. SZEBELLÉDY and W. MADIS (Z. anal. Chem., 1938, **114**, 350—352).—The Ca·· is pptd. as CaC_2O_4,H_2O by Winkler's method and, after treatment of the ppt. with 2N-H_2SO_4, the oxalate is determined as described previously (cf. A., 1938, II, 43).   L. S. T.

Application of spectral analysis to determination of calcium, sodium, potassium, and strontium in the production of rare elements. L. I. GREENHOUSE and G. M. LERMAN (Zavod. Lab., 1938, **7**, 314—321).—The most accurate results are given by Rusanov's extinction method (B., 1934, 1211). The curves connecting thickness of layer of absorbent with [Ca] are displaced by Co and Sr, but not by Ni, using 0·04% $KMnO_4$ absorbent solution, and by Ni and Na, but not Co or Sr, with 0·017% methylene-blue. Sr, Co, and Ni have no effect on the curves for Na ($KMnO_4$ absorbent). Sr is determined similarly, with 0·026% Me-violet absorbent solution; Ca, Ba, Al, Fe, and Mn displace the curves.   R. T.

Detection and determination of small amounts of metals in organic material. C. J. VAN NIEU-WENBURG (Chem. Weekblad, 1938, **35**, 799—802).—A review of the general questions involved in finding a satisfactory solution of this problem. A more satisfactory wet method of destroying org. matter is required.   S. C.

Detection of zinc with β-naphthoquinoline and thiocyanate. E. B. SANDELL, D. M. WISHNICK, and E. L. WISHNICK (Mikrochim. Acta, 1938, **3**, 204—209).—With neutral or weakly acid solutions of Zn, KCNS + β-naphthoquinoline give a finely-divided ppt. which soon recrystallises as thin, colourless, lath-shaped crystals showing parallel extinction and strong birefringence. The vols. of reagent and test drop should be approx. equal, and well mixed. When this is the case, the limiting concn. in neutral or in solutions 1 to 2N. with respect to H_2SO_4 is 1 : 2 × 10^5; in 2N-HCl, it is 1 : 10^5. Alkali metals do not interfere, and 0·001% of Zn can be detected in a saturated solution of K_2SO_4 which is 2N. with respect to H_2SO_4. In alkali chloride solution, the sensitivity is decreased, and NO_3' should be absent. Ca, Ba (AcOH solution), Mn, Mg, Be, Al, Cr^{III}, Ce^{III}, As, and Ni give no ppts. with the reagent. The reaction is suitable for the detection of Zn in presence of much Mn··. Pb·· may interfere somewhat with the detection of Zn··. Cu··, Ag·, Au, Hg·, Hg··, Tl·, Sn··, Sb, Bi, V^V, Mo^{VI}, W^{VI}, UO_2··, $PtCl_6''$, Fe··, Fe···, and Co·· give ppts. with the reagent, but low concns. of Fe·· or Fe··· in presence of H_3PO_4 do not spoil the test. Zn cannot be detected in presence of Co, which gives blue prisms with the reagent. The corresponding compound of Cd is more sol. and, in concns. <0·5% of Cd, does not interfere. Owing to its slight solubility, the compound $(C_{13}H_9N)_2,H_2CdI_4$ is not entirely satisfactory for the identification of Cd··.   L. S. T.

Determination of cadmium. E. I. NIKITINA (Zavod. Lab., 1938, **7**, 409—412).—5 ml. of 1% brucine in aq. H_2SO_4 and 10 ml. of 10% KBr are added to the neutral solution (containing <5 mg. Cd), and the ppt. of $[brucine]_2,CdBr_2,2HBr$ is collected after 1 hr., washed with 1 : 7 EtOH–Et_2O, dried at 130—150°, and weighed. Mg, Al, Cu, Mn, and Zn do not interfere.   R. T.

Selective micro-chemical test for cadmium. C. MAHR (Mikrochim. Acta, 1938, **3**, 300—303).—One or two drops of test solution are evaporated on a microscope slide, and treated with a small drop of 1—2N-HCl, a large drop of 1·5% solution of Reinecke's salt, and a drop of 5% $CS(NH_2)_2$. In presence of Cd characteristic crystals of $Cd\{CS(NH_2)_2\}_2[Cr(NH_3)_2(CNS)_4]_2$ are formed. About 0·1% of Cd can be detected in presence of metals of the $(NH_4)_2S$ and alkaline-earth groups and 0·2% in presence of metals of the HCl and H_2S groups.   J. W. S.

Micro-detection and -determination of lead. N. D. COSTEANU (Mikrochim. Acta, 1938, **3**, 236—238).—A strip of filter-paper is soaked with the test solution, free from metals other than Pb, and dried. One drop of aq. HI, prepared by the action of H_2S on a suspension of I in H_2O, is added, and the colour of the PbI_2 spot is compared with a series of standards

prepared similarly from $Pb(NO_3)_2$ solutions. 0·1 μg. of Pb can be determined in this way. L. S. T.

Analysis of dust and fumes for lead and zinc.—See B., 1938, 1509.

Volumetric determination of lead and acetic acid in neutral and basic lead acetates.—See B., 1938, 1499.

Quantitative spectral analysis of solutions. III. Determination of thallium and indium. A. K. RUSANOV and B. I. BODUNKOV (Zavod. Lab., 1938, 7, 573—579).—The [Tl] in solutions is determined by comparing the intensity of the Tl 5350·47 line with that of the Fe 5270·36—5269·54 lines, and of In by comparing In 4511·31 with Cs 4555·3 A. R. T.

Determination of copper as thiocyanate by a rapid extraction method. A. G. KULMAN and G. A. CHRAPOV-SCHMAROV (Zavod. Lab., 1938, 7, 290—295).—The accuracy of Rivot's method (Compt. rend., 1854, 38, 868) is enhanced, and the time required reduced, by introducing a no. of modifications in the technique of pptn. of CuCNS, and of washing and drying the ppt. R. T.

Reactions of thiolbenzothiazole. M. KURAŠ (Chem. Obzor, 1938, 13, 95—96).—Thiolbenzothiazole reacts with cations of the H_2S group and can be used for the determination of Cu, Cd, Bi, Pb, Au, Ag, and Hg. Indications are given of the conditions for pptn., and the colours and properties of the ppts. for the above cations. F. R.

Paper as medium for analytical reactions. Method of applying reagent papers to large volumes of solutions. B. L. CLARKE and H. W. HERMANCE (Ind. Eng. Chem. [Anal.], 1938, 10, 591—600; cf. A., 1937, I, 429).—A general technique for the removal of μg. quantities of an ion from large vols. of solution and its determination is described. The solution is passed through a known and restricted area of paper impregnated with a reagent sufficiently insol. to withstand the action of a large vol. of solution flowing through it, but capable of reacting with the ion being determined and fixing it on the reagent-coated fibres of the paper. When a colour change results, direct comparison of the coloured area with similarly-prepared standards, or ashing and digestion of the spot and the use of a suitable micro-method, allows a determination to be made. Apparatus for confining the flow of large vols. of liquid through small, definite areas of papers, for the prep. and preservation of standard spots, for the comparison of spots, and a micro-crucible for ashing are described. Precautions to be observed in the prep. of the papers are discussed. Results obtained in a typical application, viz., the removal of Cu·· on paper impregnated with CdS, are described and illustrated, with particular reference to the various factors affecting the accuracy of the results. Recovery on three paper discs is complete for amounts up to 50 μg., and the amount of Cu·· detectable is <1 μg. per 500 c.c. Other applications described are the separation of a few μg. of Cu from solutions containing a very large excess of Ni·· by retention of the Cu·· on CdS-paper, the separation of Cu from Pb, the determination of

traces of Pb in H_2O and air, and the detection and determination of Š″ in tarnish films after cathodic reduction of the film. L. S. T.

Determination of copper in pig iron and steel. —See B., 1938, 1424.

Determination of mercury with s-diphenyl-carbazide. F. W. LAIRD and A. SMITH (Ind. Eng. Chem. [Anal.], 1938, 10, 576—578).—The reagent should be dissolved in abs. EtOH, prepared fresh each day, and protected from light. When the ratio of reagent to Hg is ≮ 2 : 1, the colour intensity is independent of the amount of diphenylcarbazide. Max. colour intensity is reached within 15 min. Cd does not interfere with the reaction, and neither does Zn in a concn. <5 times the [Hg] (cf. A., 1926, 814). A [Cl′] >0·0001N. destroys the colour. An electrolyte concn. >0·003N. usually ppts. the coloured Hg compound in <1 hr., and the higher is the [Hg] the smaller is this concn. needed to produce flocculation. The colour can exist with varying intensities at p_H between 2·6 and 7; the optimum p_H is 4 and this must be kept const. to ±0·3 unit if the error from this source is to be ≯5%. A satisfactory p_H can be attained by titration of an aliquot portion with dil. AcOH or NaOAc (bromophenol-blue). With a layer of solution 10 cm. thick, 0·4 mg. of Hg per l. can be determined with a precision (photo-electric colorimeter) of ~5%; for 5—50 μg. of Hg per 10 ml., the average precision is ~3%. L. S. T.

Determination of mercury and silver in presence of other metals by means of diphenylthiocarbazone. R. I. ALEXEEV (Zavod. Lab., 1938, 7, 415—417).—30 ml. of 0·1M-$Na_4P_2O_7$ and 3 ml. of diphenylthiocarbazone solution (25 mg. in 100 ml. of 0·1M-$Na_4P_2O_7$) are added to 10 ml. of the solution under analysis, and the red coloration obtained is compared with that given by standard Hg^{II} or Ag solutions. 0·001—1 mg. of Hg^{II} or Ag may thus be determined in presence of ≯ Tl 200, As^V 100, Al 20, Mn^{III} 15, Bi, Fe^{III}, or Pb 10, U 5, Zn 1·5, Cd or Ni 1, or Co or Mo^{VI} 0·05 mg.; As^{III}, Cu^{II}, and Cr^{VI} should be absent. R. T.

Rapid determination of aluminium, calcium, magnesium, potassium, and sodium in the salts of heavy metals. I. SACHIEV (Prom. Org. Chim., 1936, 1, 164—165).—Electrolysis of dil. H_2SO_4 solutions with a Hg cathode deposits heavy metals on the Hg. Al, Ca, Mg, K, and Na are then determined in the solution as usual. CH. ABS. (e)

Titration of manganates in presence of permanganates. M. CENTNERSZWER and J. SZEDROWICZ (Bull. Soc. chim., 1938, [v], 5, 1530—1531).—Modified procedure is described (cf. B., 1926, 351). When [$KMnO_4$] is small, low results for K_2MnO_4 are obtained by the CO_2 method, but when [$KMnO_4$] = 5 × [K_2MnO_4] the reaction proceeds quantitatively according to $3K_2MnO_4 + 2CO_2 = 2KMnO_4 + MnO_2 + 2K_2CO_3$. MnO_2 is determined by adding excess of $H_2C_2O_4$ and titrating with $KMnO_4$. E. S. H.

Macro- and micro-reaction of iron with thioglycollic acid. J. V. DUBSKÝ and V. ŠINDELÁŘ (Mikrochim. Acta, 1938, 3, 258—262).—When air is excluded, Fe·· ions give no colour reaction with

$SH \cdot CH_2 \cdot CO_2H$ (I), even after addition of aq. NH_3. When air is admitted, an intense violet colour is produced. $Fe^{\cdots}$ ions produce first a blue colour due to the formation of $Fe(S \cdot CH_2 \cdot CO_2H)_3$, and then, in presence of NH_3, the violet-red colour due to $Fe(S \cdot CH_2 \cdot CO_2NH_4)_3$. Excess of $FeCl_3$ gives not $Fe(OH)_3$ but the ochre-brown aquo-salt of Fe^{III} ferrithioglycollate. For $Fe^{\cdots}$, the limiting sensitivity is 0·13 μg., and for (I), 60 μg.   L. S. T.

Micro-determination of bivalent iron in rocks and silicate minerals. M. Shiomi and S. Mitui (Mikrochim. Acta, 1938, **3**, 291—299).—5—30 mg. of the mineral is treated in a Pt basin with two quantities of 0·2 c.c. of 25 vol.-% H_2SO_4, the solution being evaporated after each addition. The mixture is then treated with about 0·3 c.c. of 40% HF in a current of CO_2 and subsequently heated in steam for 30 min. After cooling in a stream of dry CO_2 the contents are transferred to a vessel containing 0·3 g. of powdered H_3BO_3 and 7 c.c. of 2·5 vol.-% H_2SO_4 saturated with H_3BO_3, and titrated with 0·02N-$KMnO_4$. Apparatus required for the determination is described and data are recorded for results obtained with $FeSO_4,(NH_4)_2SO_4,6H_2O$, augite, olivine, olivinepyroxeneandesite, hornblende, and granite.   J. W. S.

Cerimetric determination of ferrum oxalicum oxydulatum.—See B., 1938, 1499.

Magnetic determination of iron in brass.—See B., 1938, 1433.

Spectroscopic analysis of steel alloys.—See B., 1938, 1432.

Micro-gravimetric determination of cobalt with 1-nitroso-β-naphthol. F. Hecht and F. Korkisch (Mikrochim. Acta, 1938, **3**, 313—316).— The solution containing $CoCl_2$ is evaporated to dryness and the residue taken up in a few drops of H_2O. 2 drops of conc. H_2O_2 and 1 drop of N-NaOH are added. When vigorous action has ceased the $Co(OH)_3$ is dissolved in AcOH (1·5—3 c.c.), the solution is diluted with hot H_2O (2—5 c.c.), and Co is pptd. with 1 : 2-$NO \cdot C_{10}H_6 \cdot OH$ (2% in 70% AcOH). The mixture is heated in a covered vessel at 125—130° for 5—7 min., and after cooling the coagulated ppt. is collected, washed with AcOH and then with H_2O, and dried at 130°. The use of a crucible fitted with a porcelain filter-tube is recommended. Separation from Ni, Zn, and Al is not so efficient as in the macro-procedure but is probably sufficient for normal rock analyses.
          J. W. S.

Separation of cobalt and nickel from manganese. E. A. Ostroumov and G. S. Maslennikova (Zavod. Lab., 1938, **7**, 267—269).—C_5H_5N,HCl and C_5H_5N are added to the solution containing Co, Ni, and Mn, and H_2S is passed; CoS and NiS are pptd., leaving Mn in solution.   R. T.

Volumetric determination of cobalt and nickel. —See B., 1938, 1440.

Micro-gravimetric separation of nickel and uranium. E. Kroupa (Mikrochim. Acta, 1938, **3**, 306—312).—A solution of the mixed nitrates is evaporated to dryness and the residue is treated with 50% HNO_3 (1 drop) and H_2O (5—10 c.c.). After warming, six times the theoretical amount of dimethylglyoxime (1% in EtOH) is added, then 0·5— 1 c.c. of 50% NH_4OAc, and the solution approx. neutralised with aq. NH_3 to ppt. the Ni. The solution is filtered immediately, the ppt. being washed three times with 0·5 c.c. of hot H_2O and three times with 0·5 c.c. of 25% EtOH. The filtrate, containing the U, is evaporated, ignited, dissolved in HNO_3, again evaporated to dryness, and taken up in AcOH (1 drop) and hot H_2O (0·5 c.c.). After adding 1 drop of aq. NH_3 and 0·5 c.c. of 50% NH_4OAc the mixture is warmed for 5 min. (water-bath) and then thrice the theoretical amount of 8-hydroxyquinoline (4% in 8 vol.-% AcOH) is added, excess of AcOH being neutralised with 2—4 drops of aq. NH_3. The ppt. is filtered, ignited, and weighed as U_3O_8.   J. W. S.

Detection of nickel in very dilute solutions. I. M. Korenman (Zavod. Lab., 1938, **7**, 428—429).— 1—2 drops of conc. aq. $ZnSO_4$ and of $(NH_4)_2Hg(CNS)_4$ are added to 20 ml. of solution (containing $\ll 0·01$ μg. Ni), and the solution is centrifuged. The ppt. is collected on a filter-paper spill, which is ignited, the ash is dissolved in a drop of HCl, which is made neutral with NH_3, and dimethylglyoxime in aq. NH_3 is added. The red needles of Ni salt may be detected microscopically.   R. T.

Conductometric determination of nickel. J. H. Boulad (J.S.C.I., 1938, **57**, 323—326).—A volumetric method for the determination of Ni, using electrical conductance as indicator, is described. Ni, best in neutral solution (0·003—0·015N.), is pptd. with an alcoholic solution of dimethylglyoxime (I) (about 0·1N.), in presence of $Ca(OAc)_2$ as buffer and flocculant. Titration is carried out either by adding the precipitant by successive measured amounts, or by adding an excess of (I), which is then titrated back with a solution of $Ni(NO_3)_2$ or $Ni(OAc)_2$ (0·1—0·3N.). Zn and Mn do not interfere, but in presence of Co, Fe, and Cu, slight modifications are necessary. The accuracy is about ±1% of the nickel present.

Drop method of approximate determination of chromium. G. T. Michaltschischin (Bull. Sci. Univ. Kiev, 1937, **3**, No. 3, 85—89).—Aq. Na_2CO_3 and $KMnO_4$ are added, and the solution is boiled for 5—10 min., a few drops of EtOH are added, and boiling is continued to decolorisation of the solution and to evaporation of excess of EtOH and MeCHO, when it is cooled and diluted to 25 ml. The solution is filtered, a few drops of filtrate are made acid with AcOH, and a drop is placed on a spot of saturated benzidine in 30% AcOH on filter-paper. The intensity of the coloration obtained is compared with those given by a series of standard $K_2Cr_2O_7$ solutions.
          R. T.

Colorimetric determination of chromium in plant ash, water, and rocks.—See A., 1939, III, 110.

Potentiometric determination of molybdenum and copper in steel.—See B., 1938, 1431.

Photometric determination of tungsten in steel.—See B., 1938, 1431.

Dihydroxytetrachloroplatinic acid as a reagent for tin. J. P. Chotulev (Zavod. Lab., 1938, **7**,

358—359).—Aq. $H_2[PtCl_4(OH)_2]$ and $Sn^{..}$ give a red ppt. of $Sn[PtCl_4(OH)_2]$, sol. in Et_2O, and not affected by heating at 100°. The reaction serves for detection of 1—10 p.p.m. of Sn^{II}. Ag, Hg^I, Hg^{II}, Pb^{II}, Bi^{III}, Sb^{III}, Fe, Co, Ni, and Cr do not interfere.   R. T.

Analytical use of cacothelin. L. ROSENTHALER (Mikrochim. Acta, 1938, **3**, 190—192; cf. A., 1935, 319).—Cacothelin (I) is reduced (lilac colour) directly by $Sn^{..}$, $Fe^{..}$ in presence of H_3PO_4 or F', $K_4Co(CN)_6$, H_2S, H_2Se, $CuCl$, $HgCl$ (in presence of HCl), and many org. substances such as $NHPh \cdot NH_2$, cysteine, gluta-thione, neosalvarsan, and ascorbic acid. In presence of Zn + HCl it is also reduced by As, Sb, and Te compounds, and many org. compounds containing As, Sb, or S. In order to differentiate between Sn and Mo, $HgCl_2$ is added after reduction with Zn and HCl to oxidise the $SnCl_2$ and prevent it reducing the (I) (cf. A., 1938, I, 325).   L. S. T.

Nephelometric and colorimetric determin-ation of vanadium by means of cupferron. D. N. FINKELSCHTEIN and L. P. ELENEVITSCH (Zavod. Lab., 1938, **7**, 665—670).—The solution of V^V, not contain-ing Fe, Ti, F', or Na_2O_2, is made neutral with H_2SO_4, and 1 ml. of $Sn \cdot H_2SO_4$ is added per 10 ml. of solution, followed by 2 ml. of 25% K_2SO_4. Should [Cr] be 5 times [V], the solution is boiled with a few drops of H_2O_2, cooled, and the vol. is made up to 50—250 ml. 1 ml. of 2% gum arabic (centrifuged and filtered) and 1 ml. of 1% cupferron are added to 10 ml. of the solu-tion, at 20°, and the coloration is compared with that given by standard solutions, not earlier than 5 or later than 40 min. after addition of the reagents.   R. T.

Determination of vanadium. A. F. ANDREEV (Zavod. Lab., 1938, **7**, 258—262).—V^V is reduced with Hg–Cd, according to Someya (A., 1928, 387), and V^{III} is titrated with trypan-red in $2N$-H_2SO_4. The method is applicable to the analysis of steels containing also Ti, Mo, or P, but not W.   R. T.

Volumetric determination of vanadium in presence of tungsten, with diphenylamine-sulphonic acid as indicator. G. A. PEVTZOV (Zavod. Lab., 1938, **7**, 286—289).—A sharp end-point is obtained in the titration of V^V with Fe^{II} in presence of $NHPh \cdot C_6H_4 \cdot SO_3H$ when the solution contains 10% of H_3PO_4.   R. T.

Photocolorimetric determination of vanadium in iron ores and slags.—See B., 1938, 1424.

Analytical applications of certain oxidation reactions in alkaline media. O. TOMÍČEK (Arh. Hemiju, 1938, **12**, 105—110).—The results of potentio-metric titration of V^{IV} with $0.1M$-$K_3Fe(CN)_6$ in strongly alkaline solution are 2—23% low, owing to incidental oxidation of H_2O. $VOSO_4$ in alkaline solu-tion reduces Te^{IV} or Te^{VI} to Te^{II}, and Se^{IV}, but not Se^{VI}, to Se^{II}; the method cannot, however, be applied to determination of Se or Te.   R. T.

Analysis of antimony–tin alloys.—See B., 1938, 1432.

Determination of antimony in lead and lead alloys.—See B., 1938, 1434.

Spectrographic examination of assay beads for platinum, palladium, and gold.—See B., 1938, 1435.

High-precision calorimeter. A. WELSCH (Bull. Soc. roy. Sci. Liége, 1937, **11**, 316—325).—The construction of a calorimeter which can determine the evolution of very small amounts of heat over long periods, and the method of working, are described. Temp. control is such that the interior temp. of the calorimeter can be maintained over 4 consecutive days at any appropriate temp. within 0·0005°.   J. N. A.

Gas thermometer for use at very low tem-peratures. A. H. WOODCOCK (Canad. J. Res., 1938, **16**, A, 133—137).—A thermometer, suitable for temp. 4—14° K., is described in which the vol. of gas which remains at room temp. is ∼ ten times that of the thermometer bulb proper. It is shown theoretically that with this design the sensitivity is increased at the lowest temp.   C. R. H.

Simple appliance for exact regulation of con-stancy of temperature of nichrome ovens. V. A. ZACHAREVSKI (Zavod. Lab., 1938, **7**, 353—354).—Apparatus is described.   R. T.

Liquid bath m.p. apparatus. E. C. WAGNER and J. F. MEYER (Ind. Eng. Chem. [Anal.], 1938, **10**, 584—585).   L. S. T.

Use of the calorimetric bomb for determin-ation of carbon in coal.—See B., 1938, 1377.

Thermo-electric measurement of vapour pres-sure. R. R. ROEPKE and E. J. BALDES (J. Biol. Chem., 1938, **126**, 349—360; cf. A., 1934, 983).—Comparison, by the authors' method, of the v.p. of biological material (*e.g.*, egg yolk, centrifuged blood cells, blood-serum, crushed muscle) with that of nearly isosmotic aq. NaCl has shown the method to possess great accuracy. The procedure is applicable also to determination of the v.p. of solutions of org. compounds and of the mol. wt. of the compounds. Methods of evaluating or diminishing errors due to heat production within the material under examin-ation are described.   W. McC.

Modern microscopic apparatus in chemical research and industrial laboratories. A. KUF-FERATH (Österr. Chem.-Ztg., 1938, **41**, 359—363).—Various forms of microscopes and micro-cameras, and the different types of illumination which can be used in conjunction with them, are described.   J. W. S.

Taking photomicrographs with the aid of a simple and inexpensive apparatus. R. B. JACK-SON (Chinese Med. J., 1938, **54**, 367—371).—The adaptation of a Baker (London) Metron reflex draw-ing outfit to the production of photomicrographs is described.   W. J. G.

Simple electron microscopes. R. P. JOHNSON (J. Appl. Physics, 1938, **9**, 508—516).—The simple instruments described require only a few μa. at 2000—5000 v. and a small low-tension supply. Electrons emitted from the cathode are pulled across to a fluorescent screen so rapidly that they travel in straight lines and produce a sharp image of the

emitting surface. Magnification up to 10^5 can be obtained. The method reveals the micro-cryst. structure of the metal etc. Activation and poisoning of the surface can be observed in great detail.
J. A. K.

Direct–view particle counter and portable ultramicroscope. S. C. BLACKTIN (J.S.C.I., 1938, 57, 361—363).—The instrument described embodies an inductor for maintaining the flow of gas and its fine particle content, and a cell for the viewing and counting of the particles in a known vol. of gas or liquid. Test data are reported. N. M. B.

Source of mercury resonance radiation of high intensity for photochemical purposes. E. W. R. STEACIE and N. W. F. PHILLIPS (Canad. J. Res., 1938, 16, B, 219—221).—The inexpensive lamp-reaction vessel described has a high intensity of Hg resonance radiation, viz., 1.5×10^{-5} einstein per sec., and can be operated without flickering at currents as low as 2.5 ma. C. R. H.

Departures from additivity among Lovibond red glasses in combination with Lovibond 35 yellow. G. W. HAUPT (Oil & Soap, 1938, 15, 282—287; cf. A., 1934, 624).—The statistical analysis of the regraded vals. (Priest–Gibson N'' scale) of 2700 Lovibond red glasses, which is illustrated graphically, shows the existence of important differences among the chromaticities of several glasses of nominally the same Lovibond grade, and indicates the magnitude of both regular and erratic departures (two types in each case) from additivity in the N scale. E. L.

Photographic colorimetry of dark substances. E. VON ANGERER and J. O. BRAND (Z. tech. Physik, 1938, 19, 254—259).—A method for the photographic determination of the λ of light reflected from dark-coloured surfaces is described. A. J. M.

Construction of a recording spectrophotometer. J. L. MICHAELSON (J. Opt. Soc. Amer., 1938, 28, 365—371).—Constructional details of a commercial recording photo-electric spectrophotometer are explained. The instrument consists of a mono-chromator combined with a photometer and integrating sphere. A photo-cell, suitably amplified via a thyratron stage, records optical densities on a chart, the λ scale being automatically provided by a cam connected with the monochromator system.
J. A. K.

Calibration of recording spectrophotometer. K. S. GIBSON and H. J. KEEGAN (J. Opt. Soc. Amer., 1938, 28, 372—385).—The accuracy of a commercial recording spectrophotometer (cf. preceding abstract) has been thoroughly tested for transmission, reflexion, and λ at the National Bureau of Standards. Full details of the tests are given. J. A. K.

Photo-electric colorimetry and the application of selenium photo-elements. B. LANGE (Chem.-Ztg., 1938, 62, 737—741).—A review. The construction of several commercial instruments is described and figured. I. C. R.

Photo-electric nephelometer-colorimeter. V. A. SUCHICH (Zavod. Lab., 1938, 7, 348—350).—Apparatus is described. R. T.

Accuracy of rectifier photo-electric cells. J. R. ATKINSON, N. R. CAMPBELL, E. H. PALMER, and G. T. WINCH (Proc. Physical Soc., 1938, 50, 934—946).—An investigation of the effect of a resistance in series with the cell on the linearity of the response and on the temp. coeff. of the sensitivity is reported. Results can be qualitatively explained by assuming the presence of a series resistance in the cell in addition to the shunt resistance; these two do not vary in the same manner with temp. or with illumination.
N. M. B.

Photometer with a selenium photo-element. M. Z. KRIVOV (Zavod. Lab., 1938, 7, 744—745). R. T.

Photo-electric apparatus for determining intensity of coloration of solids and powders. V. I. JUSCHANTZEV (Zavod. Lab., 1938, 7, 492—493). —Apparatus is described. R. T.

Spectrochemical study of microscopic crystals. I. Application of microscopes in spectrography. R. TSUCHIDA and M. KOBAYASHI (Bull. Chem. Soc. Japan, 1938, 13, 619—623).—A new method of measuring absorption spectra of microscopic crystals is described. The measurement of the pleochroism of microcryst. substances by means of a polarising microscope is illustrated by reference to cis-dichloro-tetramminocobaltic chloride. W. R. A.

Concave-grating vacuum spectrograph for wave-lengths 15—1000 A. F. C. CHALKLIN, S. S. WATTS, and S. P. HILLSON (Proc. Physical Soc., 1938, 50, 926—933).—The instrument described allows adjustment of the optical system before placing in the vac. chamber, thus minimising trial-and-error focusing. The grazing angle may be varied without readjustment. Tests are described and discussed.
N. M. B.

Double crystal [X-ray] spectrometer with photographic recording; measurement of the imperfection of crystals. J. FEJFER and M. JAHODA (Compt. rend., 1938, 207, 737—739).—The use of a spectrograph with fixed non-parallel crystals is described. Data for the degree of imperfection of NaCl, ZnS (sphalerite), and SnO_2 crystals, obtained by photographic measurements of the resolving power, show that each crystal has a characteristic min. imperfection corresponding with a regular mosaic structure. The mosaic structure of NaCl becomes more pronounced on depositing a film of Al on the reflecting face, ZnS being unaffected. Application of a potential gradient reduces the mosaic structure of ZnS. A. J. E. W.

Express method of X-ray structural analysis. V. I. ARCHAROV (Zavod. Lab., 1938, 7, 440—443).—A method depending on focusing of X-ray beams by " lenses " of the substance under examination is described (cf. Tech. Phys. U.S.S.R., 1936, 6, 1771).
R. T.

Powerful X-ray tube. A. I. KRASNIKOV (Zavod. Lab., 1938, 7, 307—312).—Apparatus is described.
R. T.

Electrical and luminescence properties of willemite screen material. W. B. NOTTINGHAM (Physical Rev., 1937, [ii], 51, 1008).—Surface poten-

tial, resistivity, and luminous output have been determined. L. S. T.

Differential titrations with tungsten electrode. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 363—367).—W electrodes may be used for acid–alkali titrations by the differential method. F. J. G.

Automatic potentiometric titration apparatus. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 369—371).—The apparatus uses differential electrodes of W and Ag connected to a valve system so that the p.d. can be recorded on a rotating drum by a mirror galvanometer, while the rotation of the drum automatically delivers liquid to the titration cell by lowering a sinker into the burette. F. J. G.

Apparatus with a valve amplifier for measurement of conductivity. I. V. MALASCHENKO (Zavod. Lab., 1938, **7**, 741—744).—Apparatus is described. R. T.

Differential pre-amplifier for electro-physiological purposes and for bridge measurements. H. KÖNIG (Helv. Phys. Acta, 1938, **11**, 507—512).—The amplifier described is free from magnetic interaction effects, and may be used to determine the p.d. between two points irrespective of their abs. potential. A. J. E. W.

Counter systems for measuring cosmic radiation of very small intensity. A. VAN GEMERT (Physica, 1938, **5**, 811—816).—Diagrams are given of two counter systems, used in determining the intensities of cosmic radiation in H_2O to depths ≯440 m. and in a colliery to depths ≯620 m. (equiv. to 1600 m. of H_2O) (cf. A., 1938, I, 549). J. W. S.

Investigations with detectors in the region of short electric waves. J. ROTTGARDT (Z. tech. Physik, 1938, **19**, 262—264).—The sensitivity of a no. of crystal detector combinations for dm. and cm. waves has been determined. Si–W is the most satisfactory combination in the range 50—1·4 cm. The connexion between the sensitivity of the detector and its resistance has been investigated. A. J. M.

Purification of crystalloids and colloids by electrodialysis. N. R. JOSEPH (J. Biol. Chem., 1938, **126**, 403—405).—A simple apparatus similar to that of Adair and Keys (A., 1935, 52) is described. Hg within Cellophane membranes forms the electrodes. Electrodialysis is continued until the conductivity of the solution reaches a limiting val. W. McC.

Separation of isotopes for the investigation of nuclear transmutations. E. L. YATES (Proc. Roy. Soc., 1938, **A**, **168**, 148—158).—A simple mass spectrograph, by means of which a few μg. of the separated isotopes of Li, B, and C have been prepared, is described. G. D. P.

Counting effects in [discharge] tubes with plane parallel electrodes. B. KWAL (Compt. rend., 1938, **207**, 724—726).—The sensitive zone of plane electrodes is at the edges, and efficient counting is obtained only with sharp-edged plates. A. J. E. W.

Electron-diffraction by the split-shutter method and a new back reflexion method. R. JACKSON and A. G. QUARRELL (Proc. Physical Soc., 1938, **50**, 776—782).—A method for obtaining comparison reflexion patterns by the split-shutter method is given, and a light-tight split-shutter plate-holder is described. The use of the grazing incidence method for the electron-diffraction study of surface structure is essential, but in view of its limitations the possibility of back-reflexion of electrons is considered, and experiments in which high-speed electrons diffracted through nearly 180° are recorded photographically are described. Results do not admit definite conclusions between the two- or three-dimensional nature of the diffraction mechanism involved, but developments may allow application to specimens not adaptable to direct electron-diffraction study N. M. B.

Fixation of magnetic suspension patterns. K. V. GRIGOROV (Zavod. Lab., 1938, **7**, 735—737). —The powder is applied as a suspension in 3—5% celluloid in $COMe_2$; the film remaining after drying fixes the pattern. R. T.

Magnetic powder method in foreign practice. A. G. SPEKTOR (Zavod. Lab., 1938, **7**, 296—303).— Known methods are reviewed. R. T.

Magnetic suspension method. V. I. NIKOLIN and I. J. LEVSCHUK (Zavod. Lab., 1938, **7**, 303— 306).—Applications of the method are described. R. T.

Current balance for measuring magnetic fields and susceptibilities. A. R. KAUFMANN (Rev. Sci. Instr., 1938, **9**, 369—371). L. S. T.

Effect of heat on an air-damped balance. E. L. SAYCE (Soc. Chem. Ind. Victoria, 1938, **38**, 37—42).—Erratic wandering of the rest point over an amplitude of 3 divisions of the scale, equiv. to 0·0003 g., was due to the conduction of heat from the 24-w. lamp used in the optical system of reading through its metal bracket to the metal sub-frame of the balance. L. S. T.

Semi-automatic pipette for rapid and exact delivery of solutions. N. I. STOGNI (Zavod. Lab., 1938, **7**, 626). R. T.

Macro-micro-burette. N. S. SCHUB (Zavod. Lab., 1938, **7**, 627).—A combined macro-micro-burette is described. R. T.

Titration of small volumes. (A) E. A. SCHILOV. (B) N. A. TANANAEV (Zavod. Lab., 1938, **7**, 378, 378— 379; cf. A., 1937, I, 196).—Polemical. R. T.

Use of a palladium tube in gas analysis.—See B., 1938, 1382.

Portable apparatus for determination of oxygen dissolved in a small volume of water. H. M. FOX and C. A. WINGFIELD (J. exp. Biol., 1938, **15**, 437—445).—A method for determining the amount of O_2 dissolved in H_2O is described. It requires only 1—2 c.c. of H_2O and is accurate to 2% even at low $[O_2]$. J. M. R.

Micro-analysis of gases. Apparatus for use in a dry method of analysis for carbon dioxide and oxygen. D. GILMOUR (Austral. J. Exp. Biol., 1938, **16**, 208—218).—Modifications in the method of Blacet and Leighton (A., 1931, 1027) are described,

the chief advantages lying in the facts that the bubble to be analysed is not removed from the apparatus during the course of the analysis and that the apparatus is readily cleaned. D. M. N.

Apparatus for micro-steam-distillation. J. ERDÖS and B. LÁSZLÓ (Mikrochim. Acta, 1938, 3, 304—305).—Two forms of apparatus are described, one suitable for steam-distillation of readily volatile materials and the other for less volatile materials.
J. W. S.

Automat for mercury distillation. V. A. ZACHAREVSKI (Zavod. Lab., 1938, 7, 356).—Apparatus is described. R. T.

Distillation apparatus.—See B., 1938, 1374.

Continuous high-vacuum still and b.p. apparatus, and the systematic distillation of a dewaxed lubricant fraction of petroleum. R. T. LESLIE and W. W. HEUER (J. Res. Nat. Bur. Stand., 1938, 21, 515—533).—The construction of the still and b.p. apparatus and their application to the further fractionation of a lubricating oil fraction which distilled between 135° and 270°/1 mm. are described.
C. R. H.

Glass vapour-density balance. J. H. SIMONS (Ind. Eng. Chem. [Anal.], 1938, 10, 587).—The apparatus is made entirely from Pyrex glass and gives a precision of 0·2% with pressures ~500 mm. It is useful in determining the mol. wts. of gases, and in following the course of distillation of a mixture containing a homologous series of compounds having a no. of isomerides. L. S. T.

Apparatus for safeguarding high-vacuum pumps. K. SEILER (Z. tech. Physik, 1938, 19, 283—284).—A simple apparatus for the control of the cooling H_2O of high-vac. pumps is described.
A. J. M.

Mechanical pump for the drawing of gas samples. S. B. BARKER and E. SMYTH (Proc. Soc. Exp. Biol. Med., 1938, 38, 745—748).—The pump is for drawing samples from a moving stream of gas. The samples are sucked into a cylinder by a piston which is moved by the same motor that propels the stream of gas, the movement of this piston being produced by the engagement of a ratchet tooth in a cogged wheel which moves the piston by a screw-gear. The extent of the movement is controlled by the no. of teeth through which the wheel is turned.
V. J. W.

Determination of viscosity of extremely viscous liquids and sols, by the falling-sphere method, with counterweight. A. P. VISCHNIAKOV (Zavod. Lab., 1938, 7, 685—688).—The method gives results differing by +6—7% from those given by Ostwald's method. R. T.

Taking of samples for study of kinetics of chemical reactions in liquid media. A. F. BOGO-JAVLENSKI (Zavod. Lab., 1938, 7, 733—734).—The system is distributed amongst a series of Landolt tubes, which are successively removed for analysis.
R. T.

Printing of millimetre squares on metal surfaces. O. V. ODING (Zavod. Lab., 1938, 7, 739).—A thin layer of photosensitive dichromated gelatin is placed on the cleaned surface, and mm. squares are printed out on the film from a negative. The unexposed parts are washed off, and the remaining gelatin is stained with Me-violet. R. T.

Laboratory study of explosivity of gas mixtures. M. G. GODSHELLO, I. R. MLINIK, and N. D. TABAKOV (Zavod. Lab., 1938, 7, 558—560).—Apparatus is described. R. T.

Differential indicator with a combination of membranes of different sensibility. M. B. NEIMAN (Zavod. Lab., 1938, 7, 624).—An instrument for measuring changes in gas pressures of 0·2—100 atm. is described. R. T.

Utilisation of broken condensers. G. A. BUTKEVITSCH (Zavod. Lab., 1938, 7, 628).—Uses for broken condenser jackets are suggested. R. T.

Microscopic study of processes of dendritic crystallisation, with exact time registration. B. E. VOLOVIK (Zavod. Lab., 1938, 7, 430—436).—The velocity of linear growth of NH_4Cl dendrites is registered on a series of photomicrographs, on each of which the position of the hand of a chronometer is indicated. R. T.

Heated thermometer anemometer. C. P. YAGLOU (J. Ind. Hyg., 1938, 20, 497—510).—An electrically heated coil surrounds the bulb of a glass thermometer. At any chosen voltage the air velocity can be calc. from the difference in temp. between the heated thermometer and an unheated one. By varying the voltage any velocity from 10 to 6000 ft. per min. can be accurately measured. If the thermometer bulbs are coated with Al paint the reading is unaffected by radiation and the instrument may be used near a source of radiant heat. The instrument is negligibly affected by variations in air temp., humidity, or its own convectional currents.
E. M. K.

Pressure regulator. S. C. COLLINS (Rev. Sci. Instr., 1938, 9, 374).—A regulator for the control of the pressure drop across a precision calorimeter is described. The regulator reduces the variations to 0·1% of the total pressure over an interval of several hr. and to 0·01% for ~1 hr. The pressure drop varies from 1 to 4 atm. and the exit pressure is slightly >1 atm. L. S. T.

Centrifuging of liquids. J. W. BEAMS (Science, 1938, 88, 243—244).—A modification of design which increases the efficiency of the vac. centrifuge described formerly (A., 1937, I, 635) is illustrated. L. S. T.

Centrifuges. H. P. MATTHEWS (Soc. Chem. Ind. Victoria, 1938, 38, 47—54).—Data concerning speed, power consumption, balance, centrifugal force, etc. are mentioned. L. S. T.

New type of air bearing for air-driven high-speed centrifuges. E. G. PICKELS (Rev. Sci. Instr., 1938, 9, 358—364).—An oil-damped air bearing and driving mechanism suitable for routine centrifuging work with large and heavy rotors are described. Operating characteristics are discussed. L. S. T.

Practical speed-measuring devices for high-speed centrifuges. E. G. PICKELS (Rev. Sci. Instr., 1938, 9, 354—358).—A direct-reading stroboscope

with slotted disc and friction drive, capable of registering speeds directly with an accuracy >99%, and a stroboscope utilising electrical interruption of illumination, and suitable for use with the analytical centrifuge, are described and illustrated.   L. S. T.

Design and operation of the oil-turbine ultra-centrifuge. G. BOESTAD, K. O. PEDERSEN, and T. SVEDBERG (Rev. Sci. Instr., 1938, 9, 346—353).—The development of the oil-turbine centrifuge is traced with special reference to the principles of design for max. resolving power at min. expenditure of energy. The efficiency of various types of rotors, power consumption, and running costs are discussed.   L. S. T.

Opaque ultracentrifuges for direct analysis. J. W. McBAIN (J. Physical Chem., 1938, 42, 1063—1070).—A no. of inexpensive types of opaque rotors suitable for the investigation of sedimentation equilibrium and velocity are described.   C. R. H.

Centrifuging arrangement for gravimetric micro-determinations. A. LANGER (Mikrochim. Acta, 1938, 3, 247—252).—The apparatus consists of a tube for pptn., a small sintered-glass crucible, a receiving vessel, and a stand, all of which are assembled and placed in the metal container of the centrifuge. Transference of the ppt. without loss into the weighed crucible is thus facilitated. Details of construction are illustrated.   L. S. T.

Liquids of standard viscosity. S. FUJITA (J. Soc. Chem. Ind. Japan, 1938, 41, 288—290B).—One glass and two metal balls for use in the Höppler viscosimeter were calibrated by η measurements on H_2O (taken as standard) and aq. glycerol at 19—30°. The η of standard liquids 3A and 6H (U.S. Bureau of Standards) were found to agree with the reputed vals. within 0·01 and 0·2% respectively. The η of a transformer and a turbine oil are given from 6° to 30°.   W. A. R.

Hydrogenation technique. H. JACKSON (Chem. and Ind., 1938, 1076—1077; cf. A., 1936, 1132).—Micro-technique is described, and an all-glass apparatus figured. Decahydronaphthalene and AcOH, alone or mixed, are recommended as solvents.   A. T. P.

Geochemistry.

Strontium in sea-water and its effect on calcium determinations. D. A. WEBB (Nature, 1938, 142, 751—752).—Spectrographic examination shows that Sr is pptd. with Ca as oxalate from sea-H_2O. No Sr could be detected in the filtrate and the Ca : Sr ratio in the ppt. was the same as that in the original H_2O. The errors introduced by neglecting the presence of Sr are discussed. A conventional interpretation suggested for the term " Ca content " is that " calcium " shall be taken to mean " Ca after the Sr and Ba have been replaced by Ca."   L. S. T.

Brackish-water lochs of Orkney. E. A. T. NICOL (Proc. Roy. Soc. Edin., 1938, 58, 181—191).—The salinity of the Loch of Stenness varies from 9·0 to 26·8 parts per 1000, the p_H from 9·2 to 9·8, and [Ca] is 56·0—89·0 mg. per l. The deeper H_2O shows a well-marked difference in salinity at the surface and at the bottom. The O_2 content is plentiful. The salinity of the Loch of Hannay varies from 0·6 to 4·3 parts per 1000, and the p_H from 9·0 to 9·8; the Ca content is 78 mg. per l. The bottom H_2O at one station contains 139 mg. of Ca per l.   L. S. T.

Cold water layer of the Scotian shelf. H. B. HACHEY (Science, 1938, 88, 307—308).—The temp.-salinity data reproduced from a section extending outwards from the coast near Halifax are discussed in relation to the origin of the layer.   L. S. T.

Content of heavy water in the earth at a depth of 1300 metres. L. SCHAMOVSKI and N. KAPUSTIN-SKAJA (Acta Physicochim. U.R.S.S., 1937, 7, 797—798).—The determination of the D_2O content of water taken from a depth of >1200 m. has been carried out by the flotation method. The ratio $D_2O : H_2O = 1 : 4490$ is > in ordinary water and indicates an enrichment of D_2O in the water in the deep layers of the earth. This may be due to the separation of the isotopes in the terrestial gravitation field and to the dehydration of minerals already enriched in D_2O.   W. R. A.

Glacial lake deposits in the Isar valley. E. SAUER (Min. Petr. Mitt., 1938, 50, 305—355).—Mechanical analyses of the sediments and one chemical analysis of a fresh-water limestone are given.   L. J. S.

Radium content of marine sediments from the East Indies, the Philippines, and Japan, and of the Mesozoic fossil clays of the East Indies. R. D. EVANS and A. F. KIP (Amer. J. Sci., 1938, [v], 36, 321—336; cf. A., 1938, I, 642).—The mean [Ra] in 11 terrigenous-mud, ocean-bottom deposits from the vicinity of Japan, the Philippines, and the East Indies is $2·5 \times 10^{-12}$ g. per g., which is 5 to 10 times > the usual vals. for sedimentary rocks. The terrestrial occurrences of so-called fossil deep-sea clays on Borneo, Rotti, and Timor have a lower [Ra] than contemporary deep-sea red clays or terrigenous muds. The results support the view that Ra and not U is primarily pptd. in the ocean-bottom sediments. Pptn. of U does not appear to be responsible for the high Ra content of deep-sea red clays.   L. S. T.

Composition of meteorites. H. H. NININGER (J. Geol., 1938, 46, 889—891).—The generally-accepted ideas regarding the average composition of meteorites are incorrect since they are based on collections that are not completely representative.   L. S. T.

Application of physico-chemical principles to the investigation of the properties of rocks. III. Porosity : comparison of methods and conclusions. A. H. NISSAN, C. E. WOOD, L. V. W. CLARK, and A. W. NASH (J. Inst. Petroleum Tech., 1938, 24, 585—597; cf. B., 1938, 1119).—Liquid absorption and gas expansion methods for determining the porosity of rocks are compared. A bulk vol. of 40 c.c.

provides the optimum quantity of sample for accuracy and if this figure is used the methods agree. The gas absorption method is rather more costly but the liquid absorption method takes longer.
T. C. G. T.

Petrographic analysis of "pelitigartigen" elements of tuffite from Berestowiec. J. TOKAR-SKI (Bull. Acad. Polonaise, 1938, A, 252—263).—Analytical data are discussed. W. R. A.

Geology and petrography of the Rottenmann and Solk Tauern Mts. (Styria). H. WIESENEDER (Min. Petr. Mitt., 1938, **50**, 273—304).

"Glorieta" monazite. O. B. MUENCH (J. Amer. Chem. Soc., 1938, **60**, 2661—2662).—The monazite contains Th 7·50, Pb 0·339, U 0·106%. The age of the mineral, estimated from the above ratios, is 858×10^6 years. E. S. H.

Association of several thermal and stress minerals in the Yu Hsi Kou iron-bearing district. K. TSURU (Mem. Ryojun Coll. Eng., 1935, **8**, 167—186). CH. ABS. (e)

Earths of Salinelles. V. CHARRIN (Céramique, 1938, **6**, 83—84).—The occurrence, nature, and properties of a mineral of the type $3MgO,2SiO_2,2H_2O$ are described. The sedimentary, refractory material has the composition SiO_2 52—55, MgO 20—23, Al_2O_3 3—4, Fe_2O_3 20—22, H_2O 0—1%. J. A. S.

[Structure of francolite. Isomorphism of the apatite group.] D. MCCONNELL (Amer. Min., 1938, **23**, 606).—Corrections (cf. A., 1938, I, 52, 283). L. S. T.

Johannsenite, a new manganese pyroxene. W. T. SCHALLER (Amer. Min., 1938, **23**, 575—582).—Johannsenite (I), $MnO,CaO,2SiO_2$, ρ 3·6 approx., has the same structure (X-ray photographs) as diopside and hedenbergite. (I) occurs at Bohemia mining district, Lane Co., Oregon, Hanover, N.M., Franklin, N.J., near Schio, and at Campiglia, Italy, Puebla and Pachuca, Mexico, and probably at Rezbanya, Hungary, Elba, and Algeria. The indices of refraction calc. for the pure mineral are α 1·710, β 1·719, γ 1·738; the vals. measured for samples from most of the above localities are, in general, slightly $<$ these figures. (I) readily fuses and is decomposed by evaporation with HCl. Seven chemical analyses of (I) from different localities are tabulated. The relation to other anhyd. Mn silicates is discussed. At $\sim 830°$, (I) inverts to bustamite. L. S. T.

Prehnite from Coopersburg, Pennsylvania. D. M. FRASER and R. D. BUTLER [with C. S. HURLBUT, jun.] (Amer. Min., 1938, **23**, 583—587).—Chemical and spectroscopic analyses and the optical properties of well-developed crystals of prehnite are recorded. L. S. T.

Andalusite in pegmatite from Fresno County, California. G. A. MACDONALD and R. MERRIAM (Amer. Min., 1938, **23**, 588—594).—The variation in colour from pale pink to dark reddish-violet is attributed to replacement of Al by Fe^{III}. Chemical analyses and optical properties for the light- and dark-coloured materials are given. Spectrographic analyses show that, in addition to other elements, traces of Cu, Ga, and Ge are present in both cases.

The andalusite (I) has been developed by pneumatolytic action following the crystallisation of the surrounding pegmatite. Subsequently, hydrothermal solutions have altered part of the (I) to sericite. L. S. T.

Disintegration and exfoliation of granite in Egypt. R. FARMIN (J. Geol., 1938, **46**, 892—893).—Dilation after the removal of load is the only one of suggested processes that is always available at localities where rock exfoliation is found (cf. A., 1938, I, 282). L. S. T.

Andalusite and sillimanite in uncontaminated igneous rocks. E. S. HILLS (Geol. Mag., 1938, **75**, 296—304).—Evidence that andalusite and sillimanite can crystallise as pyrogenetic minerals and that they are not invariably contamination minerals in igneous rocks is presented. L. S. T.

Metamorphosis of the amphibolite rocks of the Tatra. II. S. KREUTZ (Bull. Acad. Polonaise, 1938, A, 265—272; cf. A., 1938, I, 376).—Petrological. Chemical analyses of a gneiss, a biotite schist, etc. from the Wielicka valley are recorded, and discussed. L. S. T.

Distribution of boron in Alsatian potash salt beds.—See B., 1938, 1409.

Weathering of potash-felspar. C. W. CORRENS and W. VON ENGELHARDT (Chem. Erde, 1938, **12**, 1—22).—Details of which a preliminary account has been already given (A., 1938, I, 281). L. J. S.

Problem of the carbonate-apatites. A carbonate oxy-apatite (dahllite). D. MCCONNELL (Amer. J. Sci., 1938, [v], **36**, 296—303; cf. A., 1938, I, 52, 283).—Chemical (analysis given) and X-ray data for dahllite from Mouillac, France, support the existence of carbonate-apatites with CO_4-groups. L. S. T.

Calcio-gadolinite, a new variety of gadolinite found in Tadati village, Nagano prefecture. T. NAKAI (Bull. Chem. Soc. Japan, 1938, **13**, 591—594).—A variety of gadolinite in which the rare-earth elements are partly replaced by Ca (11·9%) is described. F. J. G.

Petrology and structure of the Franconia quadrangle, New Hampshire. C. R. WILLIAMS and M. P. BILLINGS (Bull. Geol. Soc. Amer., 1938, **49**, 1011—1043).—The rocks of this quadrangle belong to three chief groups : (i) highly metamorphosed sediments and volcanics, (ii) the sub-alkaline New Hampshire magma series, and (iii) the alkaline White Mountain magma series. In (ii) biotite is the only primary ferromagnesian mineral present in quantity, whilst in (iii) biotite is less important, but fayalite, hastingsite, and hedenbergite are common; fluorite and allanite are characteristic accessories. Chemical analyses of 8 plutonic rocks of this quadrangle are given. L. S. T.

Valdez Creek mining district, Alaska, in 1936. R. TUCK (U.S. Geol. Survey, 1938, Bull. 897B, 109—131).—The lode and placer Au deposits are described. L. S. T.

Alunite deposits of the Marysvale region, Utah. E. CALLAGHAN (U.S. Geol. Survey, 1938,

Bull. 886D, 91—134).—The geology of the district, and the history, development and production, mineralogy, type, and chemical composition of the deposits are described. The vein alunite is the K variety, whilst the Na variety, natroalunite, makes up some of the replacement deposits ; 13 analyses of the vein deposits and their wall rocks, and 39 analyses of the replacement deposits, are recorded. L. S. T.

Crystallographic study of christianite. J. WYART and P. CHATELAIN (Bull. Soc. franç. Min., 1938, 61, 121—126).—X-Ray data for christianite (I) from Richmond, Australia, give a 10·00, b 14·25, c 8·62 A., β 54° 20′; space-group $C_{2h}^2 = P2_1/m$ or $C_2^2 = P2_1$. The unit cell has a vol. of 998×10^{-24} cm.^{3}; ρ 2·204. Chemical analyses of specimens from 14 different localities show the formula to be approx. $K_2Ca_2Al_6Si_{10}O_{32},12H_2O$. (I) is analogous to harmotome in structure. L. S. T.

Microscopic-planimetric analysis of Ośnick granite in Wolhynien. J. TOKARSKI and (MME.) H. GAWIŃSKA (Bull. Acad. Polonaise, 1938, A, 343—353).—Results are recorded. W. R. A.

Leaching of granite and some other rocks. E. H. DAVISON (Min. Mag., 1938, 25, 217—220).—Aërated distilled H_2O was allowed to drip five times over crushed rocks (granite, gabbro, limestone), then evaporated, and the residue weighed and analysed. This process repeated 25 times seems to show a rhythm in the amount of material dissolved. L. J. S.

Identity of zinckenite and keeleyite. G. VAUX and F. A. BANNISTER (Min. Mag., 1938, 25, 221—227).—Zinckenite from the Harz Mts. has hitherto been described as orthorhombic, but pseudo-hexagonal by twinning, and with the composition $PbSb_2S_4$, isomorphous with chalcostibite ($Cu_2Sb_2S_4$) and emplectite ($Cu_2Bi_2S_4$). X-Ray photographs prove it to be truly hexagonal with until cell dimensions a 44·06, c 8·60 A., and space-group C_6^6 or C_{6h}^2. Keeleyite from Bolivia gives the same X-ray patterns. Recalculation of published analyses gives a closer approach to $Pb_{72}Sb_{168}S_{324} = 12(6PbS,7Sb_2S_3)$ than to $Pb_{81}Sb_{162}S_{324} = 81(PbS,Sb_2S_3)$ for the contents of the unit cell. L. J. S.

X-Ray examination of mordenite (ptilolite). C. WAYMOUTH, P. C. THORNELY, and W. H. TAYLOR (Min. Mag., 1938, 25, 212—216).—X-Ray photographs of the fibrous zeolites, ptilolite (d 2·15) from Elba, mordenite (d 2·12) from Mull, and flokite (d 2·102) from Iceland, show them to be orthorhombic with dimensions (Mull) a 18·25, b 20·35, c 7·50 A., and four mols. $(Ca,Na_2,K_2)Al_2Si_{10}O_{24},7H_2O$ in the unit cell. Pyroelectric tests were inconclusive, and the space-group is either D_{2h}^{17} or C_{2v}^{12}. L. J. S.

Low-grade metamorphic actinolitic amphibole from New Zealand. C. O. HUTTON (Min. Mag., 1938, 25, 207—211).—Chemical analysis and optical data are given of an amphibole isolated from a low-grade metamorphic albite-epidote-actinolite-chlorite-calcite-schist from Coronet Peak, Otago, New Zealand. The formula is deduced as $(OH)_2(Na,Ca)_2(Mg,Fe,Ti,Al)_5(Si,Al)_8O_{22}$. It is demonstrated that the max. angle of optical extinction in prism zone is not that on the plane (010). L. J. S.

The stilpnomelane group of minerals. C. O. HUTTON (Min. Mag., 1938, 25, 172—206).—Six chemical analyses with optical data are given of stilpnomelane from the original locality (Zuckmantel, Silesia), from Baern in Moravia, and from low-grade metamorphic schists in western Otago, New Zealand, together with seven analyses of the New Zealand rocks. They show a gradation from a dark green hydrous ferrous silicate to a brown hydrous ferric silicate, due to oxidation, and n increases progressively with the amount of Fe_2O_3. It is suggested that the original analyses of Rammelsberg (1835) were in error in stating Fe as Fe^{II} instead of Fe^{III}, and the new name ferrostilpnomelane is proposed. Parsettensite is included as a Mn member of this series, since X-ray measurements [by I. FANKUCHEN] give similar data. L. J. S.

Rocks collected by the Italian geographical expedition to Karakorum (1929). P. COMUCCI (Mem. R. Accad. Lincei, 1938, [vi], 7, 93—235).—A detailed description, with analyses, of the various metamorphic and eruptive rock specimens collected during the expedition. O. J. W.

Contact relations between rhyolite and basalt on Gardiner River, Yellowstone Park. C. N. FENNER (Bull. Geol. Soc. Amer., 1938, 49, 1441—1483).—The marked contact effects produced by a flow of mobile rhyolite over a basaltic surface are described. In many places the rhyolite penetrated deeply into the basalt as complex networks of vein and dyke-like bodies. The basalt was vigorously attacked, parts of the surface being removed, whilst near the contacts the composition of the basalt was greatly modified. Basaltic constituents were removed and rhyolite constituents substituted in such a way that the compositions of the altered rocks lie on straight lines between those of rhyolite and basalt. 18 chemical analyses of the modified and unmodified basalts and the rhyolite are given. L. S. T.

Metalliferous mineral deposits of the Cascade Range in Oregon. E. CALLAGHAN and A. F. BUDDINGTON (U.S. Geol. Survey, 1938, Bull. 893, 136 pp.).—The general geology, the mineral deposits, and numerous mines and prospects are described. L. S. T.

Clay minerals.—See B., 1938, 1415.

Mode of deposition of coal seams. Microscopic study. R. G. H. B. BODDY (Trans. Inst. Min. Eng., 1938, 96, 100—107).—Petrographic analyses of three Yorkshire seams, differing widely in character and geological age, suggest that no gross changes in manner of deposition occurred during the formation of any of the three seams, such as would be demanded by the *in situ* theory for clarain and the drift theory for durain formation. H. C. M.

Coal seams of Karawanken [Carinthia]. F. KAHLER (Berg u. Hüttenmänn. Monatsh., 1938, 86, 201—205).—The geological formation is discussed. R. B. C.

Æolian soils from Brazil. F. W. FREISE (Chem. Erde, 1938, 12, 42—49).—Chemical analyses of loose soils deficient in humus from the arid region in N.E. Brazil are given. L. J. S.

A., I.—General, Physical, and Inorganic Chemistry

FEBRUARY, 1939.

Continuous spectrum of atomic hydrogen. G. BALASSE (Bull. Acad. roy. Belg., 1938, [v], **24**, 644—652).—The continuous spectrum of at. H can be excited by the electrodeless discharge. The variation in the nature of the spectrum with increase of pressure from 0·01 mm. to >1·2 mm. is described, and the spectrum obtained at 1·2 mm. is discussed. A. J. M.

Stark effect in the HD and D_2 spectra. J. S. FOSTER, D. C. JONES, and S. M. NEAMTAN (Physical Rev., 1937, [ii], **51**, 1029).—The Stark effect in HD and D_2 in the region from H_β to H_α has been investigated, and many unclassified lines have been observed. In the D_2 spectrum the no. of components observed is ⊁ the no. predicted by theory. In the HD spectrum departures from the usual quadratic Stark effect occur. L. S. T.

Effect of crossed electric and magnetic fields on the helium spectrum. J. S. FOSTER and E. R. POUNDER (Physical Rev., 1937, [ii], **51**, 1029). L. S. T.

Positive electrode of a carbon arc in air as an absolute standardised lamp. C. KRIJGSMAN (Physica, 1938, **5**, 918—928).—The abs. spectral distribution of the energy of the positive electrode of a C arc in air has been determined. When allowance is made for the line and band spectrum of the gas of the arc the emission of the C is practically the same as the emission of a black body at 3800° K. This is valid over a range 2200—10,000 A. A. J. M.

Nuclear spin of ^{15}N. R. W. WOOD and G. H. DIEKE (J. Chem. Physics, 1938, **6**, 908).—The spin of ^{15}N has been determined from the bands of $^{15}N–^{15}N$ produced from NH_3 containing ~36% of ^{15}N. Generally the bands are confused with those of $^{15}N–^{14}N$ and $^{14}N–^{14}N$ but the 1 → 0 band of the negative band (N_2^+) is an exception, having its head at 3582·3 A. for $^{14}N–^{14}N$, 3587·4 for $^{15}N–^{14}N$, and 3592·5 for $^{15}N–^{15}N$. In this last band the P branch is free from overlapping by other bands and, on resolution with a 21-ft. grating with 30,000 lines per in. and a dispersion of 0·6 A. per mm., exhibits alternating intensities of successive rotational lines. A simplified method of intensity comparison has been developed. The nuclear spin of ^{15}N is $\frac{1}{2}$, and ^{15}N nuclei obey Fermi-Dirac statistics as indicated by even-numbered lines being weak. W. R. A.

Occurrence of atomic nitrogen in the upper atmosphere. M. NICOLET (Naturwiss., 1938, **26**, 839).—Reasons are given for supposing that the radiation of λ ~3470 A. observed in the aurora and the glow of the night sky is not due to the forbidden transition $^4S–^2P$ of N I. A. J. M.

Zeeman effect in the spectrum of argon. J. B. GREEN and B. FRIED (Physical Rev., 1938, [ii], **54**, 876—883).—Full data for measurements on about 140 lines in the region 5000—9700 A. are tabulated, and g vals. found for several complete configurations are compared with calc. vals. In some cases the agreement is good, but g sums show discrepancies which are discussed in detail. Disagreements with the measurements of other observers are examined. N. M. B.

Spectra of scandium IV and scandium V and their relation to the spectra of the isoelectronic sequences starting with argon and chlorine. L. W. PHILLIPS and P. G. KRUGER (Physical Rev., 1937, [ii], **51**, 1019).—Multiplets arising from electron transitions to the ground states of Sc IV and Sc V have been identified. The A sequence in Sc IV and the Cl sequence in Ca IV and Sc V are tabulated. L. S. T.

Spectra of scandium VI and scandium VII and their relation to the isoelectronic sequences starting with sulphur and phosphorus. H. S. PATTIN and P. G. KRUGER (Physical Rev., 1937, [ii], **51**, 1019).—The spectra of Sc have been photographed in the region 80 to 700 A. Multiplets involving radiation from electron transitions to deep terms identified in Sc VI and Sc VII are tabulated. L. S. T.

Multiplet intensities from electric furnace absorption spectra of Fe I and Ti I. R. B. KING and A. S. KING (Physical Rev., 1937, [ii], **51**, 1020). L. S. T.

Deep terms in Co VI and Ni VII. L. W. PHILLIPS and P. G. KRUGER (Physical Rev., 1938, [ii], **54**, 839—841).—Full data and classifications for about 90 lines of Ni VII and 44 deep term vals. are tabulated. Corresponding transitions identified in Co VI are compared with Bowen's analysis (cf. A., 1938, I, 377). N. M. B.

Interference measurements in the spectra of the noble gases in the ultra-violet. C. J. HUMPHREYS (Physical Rev., 1937, [ii], **51**, 1018).—Measurements of λ in the first spectra of the noble gases have been made to 3369 A. using interferometers with aluminised quartz plates and étalons. The spectra of Kr I, A I, and Xe I have been extended. 150 lines in A II have also been measured. L. S. T.

Extension of the Y I and Y II spectra. I. D. Ho and R. A. SAWYER (Physical Rev., 1937, [ii], **51**, 1020).—Of 540 Y lines identified in the region 5700—

780 A., 65 new lines are combinations of Y I and Y II energy levels established previously. The classification of 247 new lines has fixed the position of 38 new Y II levels. The Y II energy scheme does not appear to resemble that of the isoelectronic spectrum Sr I.   L. S. T.

Influence of temperature on the absorption spectrum of cadmium vapour. T. ZAMŁYŃSKI (Acta Phys. Polon., 1938, 7, 24—33).—The influence of temp. on the fluctuation bands of Cd vapour in the ultra-violet, especially the group at 2800—2590 A., has been investigated between 580° and 870°. For a const. v.p. increased temp. causes the bands to become more diffuse. The presence of band groups at 3170 A. and 3070 A. has been confirmed and two new groups at 3072—2977 A. and 2840—2800 A. are reported but their origins have not been established.   W. R. A.

Polarisation of the band fluorescence of certain metal vapours. S. MROZOWSKI (Acta Phys. Polon., 1938, 7, 45—48).—The degree of polarisation of the resonance fluorescence produced in Se and Te vapours by the 4358 A. Hg light has been measured by visual observation and vals. agree with those predicted by the theory of Placzek.   W. R. A.

Continuous spectrum of the mercury high-pressure lamp, the under-water spark, and similar gas discharges. A. UNSÖLD (Ann. Physik, 1938, [v], 33, 607—616).—Theoretical. The theory of the continuous spectra of partly ionised gases is developed and results for the high-pressure Hg lamp (Elenbaas, A., 1936, 1168) and for the under-H_2O spark (Wyneken, A., 1928, 1066) are discussed.   O. D. S.

Convection currents in mercury arcs. C. KENTY (Physical Rev., 1937, [ii], 51, 1025).—In high-intensity lamps in the vertical position there is a strong upward current in the core and a slower downward current of cold gas near the walls.   L. S. T.

Influence of added gas on absorption of 4078 A. Hg line by selenium vapour. T. SKALINSKI (Acta Phys. Polon., 1938, 7, 177—185).—Absorption measurements have been made with a monochromator and Lummer–Gehrcke plate. The spectrum of Se vapour is complicated by the presence of isotopes so that the rotational lines are not clearly separated. The broadened 4078 A. Hg line covered 6 Se absorption lines. The addition of N_2 (pressure 33·5 mm.) to saturated Se vapour at 780° produced an increase of absorption of 12·5%. This provides indirect confirmation of the predissociation character of the quenching of Se fluorescence by added gases.   J. A. K.

Wave mechanical treatment of [pressure] broadening of [spectral] lines. II. A. JABLONSKI (Acta Phys. Polon., 1938, 7, 196—206).—Theoretical.   J. A. K.

Resonance broadening of spectral lines. W. V. HOUSTON (Physical Rev., 1938, [ii], 54, 884—888).—Mathematical.   N. M. B.

Measurement of hyperfine structure separations. D. H. TOMBOULIAN and R. F. BACHER (Physical Rev., 1937, [ii], 51, 1020).   L. S. T.

Helium and hydrogen content of the interior of the stars. B. STRÖMGREN (Astrophys. J., 1938, 87, 520—534).—Weizsäcker's theory (A., 1937, I, 214) leads to the conclusion that at the present time the He content of the stars must be ≮6 times that of the heavy elements.   L. S. T.

Fraunhofer intensities in the infra-red region 8800—11,830 A. C. W. ALLEN (Astrophys. J., 1938, 88, 125—132).—Equiv. breadths, measured photometrically for 188 absorption lines in the solar spectra between 8800 and 11,830 A., are tabulated.   L. S. T.

Evidence for complex structure in lines of interstellar sodium. C. S. BEALS (Astrophys. J., 1938, 87, 568—572).   L. S. T.

Lines of ionised barium in stellar spectra. C. G. BURWELL (Astrophys. J., 1938, 88, 278—284).—Five A-type stars in which the red triplet of Ba II is abnormally intense have been found.   L. S. T.

Blue sunlit aurora rays and their spectrum. C. STÖRMER (Nature, 1938, 142, 1034).—Photographs of spectra of blue auroras at a height of ∼400—650 km. are reproduced. The relative intensities of the lines 6300, 4278, and 3914 A. to 5577 A. have increased 6—8 times compared with the same lines in yellow-green curtains of the auroras in the earth's shadow at 92 km.   L. S. T.

Balmer discontinuity in the spectrum of super-giant stars of types B, A, and F. D. BARBIER, D. CHALONGE, F. SCHAHMANÈOHE, and (MLLE.) N. MORGULEFF (Compt. rend., 1938, 207, 895—897).   A. J. E. W.

Spectrum of γ Cassiopeiæ in the photographic region. R. B. BALDWIN (Astrophys. J., 1938, 87, 573—576).—The spectrum contains many lines of ionised Fe, and the Balmer series has been measured from $H\beta$ to $H32$. One Ca III line has been identified. Al II, Ca II, Cr II, He I, Mg II, Ni II, Si II, and Ti II are present, and A II, Cr I, Mg I, Mn I, S II, and Sc II have been identified provisionally.   L. S. T.

Arcs of various metals in capillary tubes. V. Voss (Phil. Mag., 1938, [vii], 26, 1000—1006).—Arcs of Cd, Zn, Tl, Te, Bi, Sb, and Pb have been constructed in SiO_2 capillary tubes by a method which is described and characteristics of the spectrum of each are noted. The method is applicable only to metals which do not attack SiO_2 and for those of b.p. < the softening temp. of SiO_2. Observed reversal of lines is discussed.   W. R. A.

Formation of metallic bridges in separated contacts. G. L. PEARSON (Physical Rev., 1938, [ii], 51, 1015).—Low-resistance bridges are formed between Au, steel, and C electrodes having separations of 2 to 70 × 10^{-6} cm. by applying voltages < the min. sparking potential. For a given pair of electrodes the field required to form bridges is a const. (5 to 16 × 10^6 v. per cm.). The data obtained indicate that electrostatic force pulls material from the electrodes to bridge the gap.   L. S. T.

Effect of temperature on the intensity of X-ray reflexion. E. A. OWEN and R. W. WILLIAMS (Nature, 1938, 142, 915).—Results obtained for reflexion from Cu show that throughout the range

290—840° K. the decrease of intensity with a rise in temp. is > that predicted by the Debye–Waller formula. L. S. T.

Hyperfine structure of X-ray [spectrum] lines. V. Dolejšek, J. Bačkovský, and J. Faus (Compt. rend., 1938, **207**, 911—913).—The Cu $K\alpha$ line (normal width $\Delta\lambda \sim 0.4$ X.) has been split into a doublet in which the components have $\Delta\lambda$ 0.04 X., using $CaSO_4$, NaCl, or ZnS crystal gratings with slit–crystal and crystal–plate distances of 300 and 5 cm., respectively. The possibility that the doublet constitutes hyperfine structure is discussed. A. J. E. W.

Theory of the Compton effect. E. Gora (Acta Phys. Polon., 1938, **7**, 159—176).—Mathematical. J. A. K.

Shape of the modified Compton line for hydrogen and Ceylon graphite scatterers. H. A. Kirkpatrick and J. W. M. Du Mond (Physical Rev., 1938, [ii], **54**, 802—808; cf. A., 1937, I, 590).—The characteristic K radiation from a Mo target X-ray tube was scattered almost directly backwards by H_2 at 10 atm. After 1914 hr. exposure in a spectrograph the modified line was studied with a microphotometer. The breadth of the composite modified line of the α doublet was 15.2 X., or 10% > that computed from the electron momentum distribution. No evidence was found of any departure of the electron momenta from an isotropic directional distribution in Ceylon graphite (cf. A., 1932, 670). N. M. B.

Thermionic emission from platinum in hydrogen and oxygen. S. Kalandyk (Acta Phys. Polon., 1938, **7**, 68—80).—The negative thermionic emission from Pt in H_2 can be increased by previous oxidation of the surface. At $\sim 1400°$ a surface compound, probably PtH, is formed, the emission from which is independent of the H_2 pressure. At pressures of from 1 to 0.1 mm. Hg the emission $\propto p^2$, whilst at lower pressures it is $\propto p$. No notable differences have been observed between the influence of H_2 and D_2 on the emission. Glowing Pt gives no positive emission in H_2. The positive emission from Pt in O_2 diminishes with time. At const. temp. it varies with the pressure according to the law $i=cp^z$, where z is dependent on the glow temp. of the Pt. W. R. A.

Oxide-coated filament. Relation between thermionic emission and the content of free alkaline-earth metal. C. H. Prescott, jun., and J. Morrison (J. Amer. Chem. Soc., 1938, **60**, 3047—3053).—The relation has been investigated quantitatively for filaments consisting of a Pt-Rh core coated with a colloidal mixture of BaO, SrO, finely-divided Ni, and free alkaline-earth metal. High activity was found at 15—60 μg. per sq. cm. of equiv. Ba, with a slight apparent max. at 30 μg. per sq. cm., where the thermionic current at 1050° K. is 600 ma. per sq. cm. The radiant emissive power at 0.66 μ. is approx. 40%, independently of the content of active metal. E. S. H.

Secondary electron emission. II. Absorption of secondary electrons. III. Secondary electron emission caused by bombardment with slow primary electrons. H. Bruining (Physica, 1938, **5**, 901—912, 913—917; cf. A., 1938, I, 109).—

II. The secondary emission of Li, Ba, and Ni at various angles of incidence of the primary electrons has been determined. Experiments were also carried out with BaO and MgO but with less certain results. The variation of the secondary emission (δ) with angle of incidence (θ) is given by $\delta_\theta = \delta_0 e^{p(1+\cos\theta)}$, where p is const. p for Ni < for Ba < for Li. The absorption of secondary electrons causes the secondary emission of metals with large at. vol. to be < that of metals with small at. vol. when primary electrons are incident perpendicularly.

III. The secondary emission of Ba, Ag, and BaO has been investigated when the substances were bombarded with very slow electrons normal to the surface, thus eliminating absorption phenomena. The coeff. of elastic reflexion (δ_r) decreases with increasing energy (V_p) of bombarding electrons. δ_r is particularly large for BaO, and for Ag is > for Ba. The secondary emission at small V_p is determined by the work function. For $V_p > 30$ v. the secondary emission of Ag is > that of Ba, but for $V_p < 30$ v. the reverse is the case. Compounds of electropositive elements show a high capacity for secondary emission and for reflexion. A. J. M.

Variation in mass of very fast electrons. H. Lahaye (Ann. Physik, 1939, [v], **34**, 60—76).—The mass of electrons emitted from Ra has been compared with that of 7-kv. electrons by the method of Nacken (A., 1935, 1047). The variation in mass with velocity 0.698—0.888 of the velocity of light agrees with the theory of Lorentz. O. D. S.

Behaviour of electrons in iodine vapour. R. H. Healey (Phil. Mag., 1938, [vii], **26**, 940—953). —The motion of electrons in I has been studied by methods similar to those adopted for Cl_2 and Br (A., 1935, 677; 1937, I, 437). The properties of the three halogens are very similar. W. R. A.

Slow electron scattering and the apparent electron affinity of mercury. J. H. Simons and R. P. Seward (J. Chem. Physics, 1938, **6**, 790—794). —The scattering of slow electrons by gaseous mols. is discussed with a view to explaining the curves obtained when the apparent scattering area is plotted against a function of the electron velocity. Peaks frequently observed near the ionisation potential are attributed to formation or presence of positive ions. As the accelerating potential is lowered below the ionisation potential a rise in the curve is sometimes found and this appears to be the result of an attractive force between the electron and neutral mol. and, for Hg, this attractive force approximates to an inverse fourth-power law. W. R. A.

Sign preference in cloud condensation on gaseous ions. J. W. Beckman and L. B. Loeb (Physical Rev., 1938, [ii], **54**, 862—863; cf. A., 1938, I, 346).—Investigations on highly purified CCl_4 and C_6H_6 vapours alone and, in the case of C_6H_6, contaminated with traces of H_2O indicate that the existence of sign preference is due to the presence of H_2O vapour. N. M. B.

Law of distribution of mobilities of large ions. H. Le Boiteux and O. T. Tchao (J. Phys. Radium, 1938, [vii], **9**, 501—504).—Utilising the ultramicro-

scopio examination of trajectories of ions under the influence of an alternating electric field, the distribution of mobilities of the large ions produced in a smoke has been determined. The mean mobility is 3.6×10^{-5} cm. per sec. per v. cm. From Stokes' law this yields a mean particle radius of 2×10^{-5} cm., in agreement with results from other methods.　　W. R. A.

Coefficient of combination between small and large ions. G. R. WAIT (Physical Rev., 1937, [ii], **51**, 1025).—The average of a considerable range of vals. for the coeff. is 9×10^{-6}. The coeff. varies with temp. and abs. humidity of the air, because of the variation in size of the large ion with humidity.　　L. S. T.

Ionisation of air in an air-conditioned building. F. BĚHOUNEK and J. KLETSCHKA (Nature, 1938, **142**, 956).—Data showing the concn. of positive and negative ions in the air of a closed building provided with Carrier air-conditioning equipment are tabulated. A large increase in the no. of negative ions, due to the break-up of H_2O droplets, is soon reduced by the action of the walls and objects in the rooms. The average ionisation in the rooms, corridors, and hall is twice as great as in the open air, with, in general, a slight excess of negative over positive ions.　　L. S. T.

Formation of negative ions by positive ion impact on surfaces. R. H. SLOANE and R. PRESS (Proc. Roy. Soc., 1938, **A, 168**, 284—301).—A mass spectrograph in which beams of positive ions impinge on a metal disc and are found to produce a spectrum of negative ions is described. Hg^+ and Hg^{++} produce an ion of mass 28 which is believed to be CO^- (cf. A., 1938, I, 337).　　G. D. P.

Focussing of charged particles by a spherical condenser. E. M. PURCELL (Physical Rev., 1938, [ii], **54**, 818—826).—The paths of charged particles traversing a portion of an ideal spherical condenser are worked out, and the relativistic modification of the theory for high-speed particles is discussed. Results are applied to the construction and operation of a spherical condenser spectrograph.　　N. M. B.

Limiting density and mol. wt. of ethylene. Revised at. wt. of carbon. E. MOLES, (MLLE.) M. T. TORAL, and A. ESCRIBANO (Compt. rend., 1938, **207**, 1044—1046).—The density of C_2H_4 at 1.00, 0.750, 0.667, 0.500, 0.333, and 0.250 atm. has been determined; the limiting density is $(1.25122 \pm 0.000003) + 0.009133p$ (p = pressure). The mol. wt. with respect to O_2 is 28.046 ± 0.001 and, taking the at. wt. of H as 1.0081, the at. wt. of C is $12.007 \pm 0.000_6$.　　W. R. A.

Formation of a stable isotope of helium of mass five during collisions between deuterons and α-particles. F. JOLIOT and I. ZLOTOWSKI (J. Phys. Radium, 1938, [vii], **9**, 403—410).—Wilson cloud tracks of the particles emitted when heavy paraffin is bombarded with α-particles show the presence of protons and deuterons in the ratio of 2:3. Their energies have been evaluated. To interpret the emission of protons it is necessary to postulate the reaction ${}^4_2He + {}^2_1D \rightarrow {}^5_2He + {}^1_1H +$ Q Me.v. The max. energy of the projected protons is 3.2 Me.v. which leads to the mass of ${}^5_2He$ being 5.0106 ± 0.0005 and its nucleus is consequently stable with respect to neutron emission. Absorption curves for the bombardment of light and heavy paraffin by α-particles have been obtained and confirm the existence of the stable ${}^5_2He$ nucleus.　　W. R. A.

Stable and radioactive nuclei. R. GRÉGOIRE (J. Phys. Radium, 1938, [vii], **9**, 419—427).—A classification.　　W. R. A.

Is there a group of radioactive elements in the place reserved for actinium in the periodic system? G. E. VILLAR (Anal. Asoc. Quím. Argentina, 1938, **26**, 126—128).—Elements of at. no. 89 to 103 including $R_{3.5A}$ (Curie and Savitch, A., 1938, I, 381) are considered to form a group analogous, in properties and periodic position, to the rare earths.　　F. R. G.

Scattering of fast β-particles by mercury nuclei. A. BARBER and F. C. CHAMPION (Proc. Roy. Soc., 1938, **A, 168**, 159—167).—The scattering of particles of 1 mv. energy at angles $>20°$ is examined in an expansion chamber. The no. scattered is $<$ that predicted by theory. It is suggested that the results can be explained by assuming a repulsive field between electron and nucleus at small distances.　　G. D. P.

Absorption method for the study of β-particles of high energy. G. GUÉBEN (Ann. Soc. Sci. Bruxelles, 1938, **58**, 236—247).—The following vals. of the mean effective penetrations of β-particles, R and R^* (as defined by Feather and Baschwitz, respectively), have been determined: radio-Ir, 1.02 ± 0.02, 0.91; radio-Au, 0.45 ± 0.02, 0.35; ${}^{76}As$, >1.4, >1.3; ${}^{32}P$, 0.85 ± 0.03, 0.84 g. per sq. cm. These results are in agreement with the relations $R = 0.511E - 0.091$ and $R^* = 0.464E - 0.102$, where E is the limiting energy. Previous data for other elements are discussed.　　A. J. E. W.

Measurement of γ-radiations of high frequency by the materialisation pair method. C. MAGNAN (Compt. rend., 1938, **207**, 857—859).—The electron and positron energy spectra for materialisation of the 2.62 Me.v. γ-radiation of radio-Th have been studied. Corresponding peaks are observed for energies of 0.78 (electrons) and 0.734 Me.v. (positrons); the peaks are narrow, in disagreement with the Bethe–Heitler theory (cf. A., 1934, 1150). An apparatus with magnetic focussing for the study of materialisation pairs, in which the γ-rays have no direct action on the counters, is described.　　A. J. E. W.

γ-Radiation of radio-actinium. J. SURUGUE (J. Phys. Radium, 1938, [vii], **9**, 439).—The ray 240 ke.v. indicated by Frilley from work on diffraction of γ-rays by a crystal (A., 1938, I, 288) allows the correct interpretation of the two rays N_1 and Oc_3 previously observed in the study of radio-Ac (*ibid.*, 56).　　W. R. A.

γ-Radiation of the active deposit of actinium. S. P. CHOONG and J. SURUGUE (J. Phys. Radium, 1938, [vii], **9**, 437—439).—Among the rays observed in the secondary β spectrum of the active deposit of

Ac obtained with very long exposures, three new γ-radiations have been detected. On the basis of these rays, an energy level diagram can be drawn which explains the transformation Ac-$B \to$ Ac-C. In the Ac-$C \to$ Ac-C'' transformation one new ray only is indicated.　　　　　　　　　　　　W. R. A.

Multiple scattering and stopping of electrons. M. E. ROSE (Physical Rev., 1937, [ii], **51**, 1024).—The scattering and stopping of electrons in a foil thick enough to produce multiple scattering have been investigated. A relationship between the half-val. thickness and γ-ray energy, obtained for Al, shows that the assumption of linearity is unsatisfactory. The calc. half-val. thickness in Al for the Th-C'' (2·62 Me.v.) γ-ray is 0·27 g. per sq. cm., in agreement with Fleischmann's experimental val.
　　　　　　　　　　　　　　　　L. S. T.

Velocity distribution of thermal neutrons. G. E. F. FERTEL, P. B. MOON, G. P. THOMSON, and C. E. WYNN-WILLIAMS (Nature, 1938, **142**, 829).—An apparatus for measuring the distribution of velocities of neutrons from a source surrounded by paraffin is described. The source is a tube of the Oliphant type yielding deuterons, which strike a target of heavy ice, and the discharge producing the ions is made intermittent. The distribution found for 1556 neutrons is in fair agreement with Maxwell's law, especially for the slower neutrons.　　　L. S. T.

Discrete groups of particles emitted during disintegration of nitrogen by fast neutrons. J. THIBAUD and P. COMPARAT (Compt. rend., 1938, **207**, 851—853).—The previously reported group of particles of energy 1·30 Me.v. (A., 1938, I, 489) has been resolved into two groups (1·25 and 1·42 Me.v.), and two new groups (0·65 and 0·75 Me.v.) are reported. The 14 observed groups probably correspond with nuclear resonance levels of ^{15}N possessing energies of 11·6—14·2 Me.v., which are divisible into two groups with different energy increments.　　　A. J. E. W.

Soft radiation emitted on capture of neutrons by [atomic] nuclei. B. PONTECORVO (Compt. rend., 1938, **207**, 856—857).—A soft radiation, recorded by a Geiger counter, is obtained from sheets of Cd (0·03) and Au (0·01 mm.) on bombardment with neutrons from a Rn–Be or radio-Ac-Be source. The radiation from Cd is reduced to half the initial intensity by 0·03 mm. of Al; it consists of electrons and is related to the strong absorption of thermal neutrons by Cd. In each case the radiation is ascribed to internal nuclear transitions involved in reversion to a fundamental state after neutron capture (cf. A., 1938, I, 491). A counter with a thin Cd window is a sensitive detector of thermal neutrons.
　　　　　　　　　　　　　　　A. J. E. W.

Magnetic scattering of neutrons. P. N. POWERS (Physical Rev., 1938, [ii], **54**, 827—838; cf. A., 1937, I, 211, 441).—The neutron polarisation, due to selective scattering, when a beam of neutrons is transmitted through or scattered from a magnetised Fe plate was investigated. The dependence of observed polarisation on thickness of Fe agrees with theory (cf. Bloch, A., 1936, 1103; Schwinger, A., 1937, I, 275). Magnetic interaction increased rapidly for lower energy neutron energies. The effective cross-

sections $\times 10^{21}$ of Fe for neutrons of spin $+\frac{1}{2}$ and $-\frac{1}{2}$ are 13·7 and 10·3 sq. cm. for ~300° K. neutrons, and 14·1 and 9·9 sq. cm. for ~120° K. neutrons. The intensity of neutrons scattered from a single Fe plate decreases when the plate is magnetised. Experiments with two plates (polariser–analyser action) show the existence of non-adiabatic transitions of the magnetic spin quantum nos. of the neutron in rotating or precessing magnetic fields. By a method depending on measuring the probability of non-adiabatic transitions in a controlled precessing magnetic field, the neutron magnetic moment is shown to be negative and to have the val. ~2±1 nuclear magnetons.
　　　　　　　　　　　　　　　N. M. B.

Neutron absorption limit in cadmium. M. S. LIVINGSTON and J. G. HOFFMAN (Physical Rev., 1937, [ii], **51**, 1021).—The high energy limit of neutrons absorbed in Cd has been investigated by measuring the absorption of the transmitted neutrons in B. The slow neutron absorption coeff. is 36 sq. cm. per g. of B, and the absorption coeff. for neutrons just penetrating Cd is 9·5 sq. cm. per g. of B. L. S. T.

Neutron absorption limit of cadmium. J. G. HOFFMAN and H. A. BETHE (Physical Rev., 1937, [ii], **51**, 1021—1022).—The data obtained previously (cf. preceding abstract) give 0·37 v. for the absorption limit of Cd, which therefore absorbs not only thermal neutrons but also neutrons of much greater energy. The calc. resonance energy and the width of the resonance level are both 0·16 v.　　　L. S. T.

Neutron energy levels. J. H. MANLEY, H. H. GOLDSMITH, and J. S. SCHWINGER (Physical Rev., 1937, [ii], **51**, 1022).—Absorption measurements have been made on Rh, In, and Ir with the same substance as absorber and detector, and the experimental curves are compared with the theoretical.
　　　　　　　　　　　　　　　L. S. T.

Scattering of neutrons absorbed by iodine. A. C. G. MITCHELL and R. N. VARNEY (Physical Rev., 1937, [ii], **51**, 1021).—Using CHI$_3$ in paraffin as a detector of I neutrons, and neutrons slowed by paraffin and filtered from thermal neutrons, scattering curves for Fe, Ni, and Pb show no marked difference between the scattering cross-section for I neutrons and that for the A, B, C, and D groups. The scattering curve for Ag is similar to that obtained using a Ag detector and neutrons filtered through Cd.　　　L. S. T.

Diffuse reflexion of neutrons from a plane surface. O. HALPERN, R. LUENEBURG, and O. CLARK (Physical Rev., 1937, [ii], **51**, 1020—1021).—Theoretical.　　　　　　　　　　L. S. T.

Artificial disintegration and radio-activation. II. G. GUÉBEN (Ann. Soc. Sci. Bruxelles, 1938, **58**, 248—273; cf. A., 1938, I, 112).—A detailed survey and bibliography of artificial radioactivity phenomena reported during the latter part of 1937 and early in 1938.　　　　　　　　　　　　A. J. E. W.

Determination by the Wilson method of the nature and energy of the particles emitted during transmutation. Application to the disintegration of $^{10}_5$B by α-particles. F. JOLIOT and I. ZLOTOWSKI (J. Phys. Radium, 1938, [vii], **9**, 393—402).—The energies of particles emitted during

transmutation may be calc. from the curvature of the trajectories produced by large applied magnetic fields. An apparatus is described in which fields of 16,000 gauss are employed. For the reaction $^{10}_{5}B + ^{4}_{2}He \rightarrow ^{13}_{6}C + ^{1}_{1}H + Q$ a group of protons is found corresponding with $Q = 4\cdot4$ Me.v. and another group of comparable intensity with $Q = 2\cdot0$ Me.v. A group with $Q = 3\cdot1$ Me.v., previously reported, was not found.   W. R. A.

Experiments of the transmutation of fluorine by protons and deuterons. W. E. BURCHAM and C. L. SMITH (Proc. Roy. Soc., 1938, A, 168, 176—190). —The α-particles emitted by F under bombardment by protons of $0\cdot85 \times 10^6$ e.v. energy consist of a single group of range 5·90 cm. The at. wt. of ^{19}F is deduced to be 19·0043. A more complex spectrum of α-particles is produced by bombardment with deuterons and the emission of a group of protons is associated with the formation of radioactive ^{20}F.   G. D. P.

Search for long- or short-lived radio-chlorine. D. C. GRAHAME (Physical Rev., 1938, [ii], 54, 972).— The absorption curve of radiation emitted by C_2Cl_6 during irradiation with slow neutrons shows no evidence of a short-lived β-emitting active isotope. Bombardment of highly purified NaCl in a cyclotron yielded a product with no detectable activity; hence any long-lived active isotope must have a lifetime >200 years, or else is indetectable because of K-electron capture.   N. M. B.

Proton-induced radioactivity of elements of atomic number greater than 11. S. W. BARNES, L. A. DUBRIDGE, E. O. WIIG, J. H. BUCK, and C. V. STRAIN (Physical Rev., 1937, [ii], 51, 1012).—Si, Ca, Ti, Cr, Mn, Co, Ni, Zn, As, Se, Cd, In, Sn, and Sb become radioactive when bombarded by 3·6-Me.v. protons. Relative activities are 6, 21, 30, 5, 27, 6, 21, 40, 13, 2000, 10, 20, 3, 2, and 1, respectively. Only Mn (11·3 min.) and Co (14·3 min.) yield products having a single period. Mg, Al, S, Cl, Fe, Cu, and Ag show no induced activity under the same conditions.   L. S. T.

Neutron-induced radioactivity in niobium. R. SAGANE, S. KOJIMA, G. MIYAMOTO, and M. IKAWA (Physical Rev., 1938, [ii], 54, 970; cf. Oldenberg, A., 1938, I, 113).—Weak activities of periods 7·5 min., 66 hr., and 11 days were detected. Provisional data and assignments are tabulated. Results are compared with those of Pool (cf. A., 1937, I, 490).   N. M. B.

Nuclear isomerism in rhodium. E. C. CRITTENDEN, jun., and R. F. BACHER (Physical Rev., 1938, [ii], 54, 862).—The β-ray spectra associated with the 4·2-min. and 44-sec. periods of ^{104}Rh are identical in shape and end-point. On bombarding thin sheets of Rh with neutrons the two isomerides were separated by varying the time of activation and time of observation. The end-points extrapolated from the Konopinski–Uhlenbeck diagrams were $2\cdot76 \pm 0\cdot06$ and $2\cdot74 \pm 0\cdot06$ Me.v., respectively. Results agree, in general, with those of Pontecorvo (cf. A., 1938, I, 594).   N. M. B.

Radioactive isotopes of iodine. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], 54, 775—782).—The bombardment of I, Fe, or Sb by neutrons, deuterons, or He ions gave rise to I isotopes 128, 126, 124, 129, or 131, and 130, the three last-named being new. Full data for probable reactions, assignments, properties, and decay and absorption curves are given. The assignments, half-life, and decay activities are : ^{128}I from $I + n$ and Te + D, 25 ± 1 min. (—); ^{126}I from $I + $ fast n, Te + D and Sb + He, $13\cdot0 \pm 0\cdot3$ days (—); ^{124}I from Sb + He, $4\cdot0 \pm 0\cdot3$ days (+); $^{129 \text{ or } 131}I$ from Te + D and $^{129,\ 131}Te \rightarrow ^{129,\ 131}I$, $8\cdot0 \pm 0\cdot2$ days (—); ^{130}I from Te + D, $12\cdot6 \pm 1\cdot0$ hr. (—).   N. M. B.

Artificial production of uranium-Y from thorium. Y. NISHINA, T. YASAKI, M. KIMURA, and M. IKAWA (Nature, 1938, 142, 874; cf. A., 1938, I, 381). —Bombardment of $Th(NO_3)_4$ by fast neutrons from Li + 3-Me.v. deuterons gave a product showing two periods of β-decay (negative), one that of ^{233}Th, and the other that of U-Y (24·5 hr.) formed according to the reaction $^{232}Th + ^{1}n \rightarrow ^{231}U$-$Y + 2^{1}n$.   L. S. T.

Radiation from a substance of period 3·5 hours formed by irradiation of uranium by neutrons. (MME.) I. CURIE, P. SAVITCH, and A. M. DA SILVA (J. Phys. Radium, 1938, [vii], 9, 440; cf. A., 1938, I, 291, 381).—The β-ray spectrum of this element has been examined. The limiting energy is ~3·2 Me.v.   W. R. A.

Residual currents and deep-water measurements of cosmic rays. S. SZCZENIOWSKI and S. ZIEMECKI (Acta Phys. Polon., 1938, 7, 59—67).— Using two ionisation chambers, filled with air and A, respectively (max. pressure 30 atm.), residual currents have been measured at a depth of 406 m. in a rock-salt mine. As the pressure inside the chambers was decreased the residual current decreased irregularly, and, at lower pressures (11 atm. for A, 16 atm. for air), the direction of the current was reversed. This is attributed to the emission of positive particles from the walls of the chamber. These data are discussed in relation to those of Clay (A., 1935, 426) and Corlin (A., 1934, 128).   W. R. A.

Nuclear disintegrations by cosmic-rays. W. HEITLER (Physical Rev., 1938, [ii], 54, 873—876).— A detailed discussion is given of the possible mechanism of some rare instances of nuclear disintegrations by cosmic-rays observed in the Wilson cloud-chamber (cf. Brode, A., 1938, I, 114).   N. M. B.

Determinations of ionisation in the troposphere. J. JUILFS (Naturwiss., 1938, 26, 789— 790).—The ionisation produced by the softer components of cosmic radiation has been investigated at various heights up to 5 km. by balloon ascents. To determine the dependence of ionisation on the d of the gas, two ionisation chambers were used, one filled with air, and the other with Ne, A, or Kr. The curve of intensity of ionisation against height shows a no. of inversions at the boundary layers. The intensity of the ionisation $\propto d$ of the gas in the chamber. The cause of the additional radiation at the boundary layers is discussed. It is possible that it may be due to " clouds " of radioactive meteoric material.   A. J. M.

Evidence of neutrons in heavy particle showers. D. K. Froman and J. C. Stearns (Physical Rev., 1938, [ii], 54, 969—970).—Data on the dependence of counting rates on the positions of various arrangements of counters and Pb scatterers and paraffin absorbers are given and discussed. There is some support for the hypothesis that neutrons are produced in Pb by non-ionising radiations.　　　N. M. B.

Absorption of the penetrating component of cosmic radiation. W. Heisenberg (Ann. Physik, 1938, [v], 33, 594—599).—Theoretical. The effect of absorption due to spontaneous decomp. and to exchange reactions with at. nuclei on the variation of cosmic-ray spectrum with depth is calc.　　　O. D. S.

Angular spread of hard cosmic-ray showers. G. Wentzel (Physical Rev., 1938, [ii], 54, 869—872).—A modification of theory to account for the results of Schmeiser (cf. A., 1938, I, 291).
　　　N. M. B.

Study of large cosmic-ray showers at an altitude of 3500 m. P. Auger (Compt. rend., 1938, 207, 907—910).—Absorption and cloud-chamber experiments are described. Previous conclusions (A., 1938, I, 428) are confirmed; the showers contain a component penetrating 10 cm. of Pb, and are caused by the entrance into the atm. of particles of energy > 10^{13} e.v.　　　A. J. E. W.

Spontaneous disintegration of mesotrons, particles composing penetrating cosmic radiation. P. Ehrenfest, jun., and A. Fréon (Compt. rend., 1938, 207, 853—855).—Experiments at high altitude have verified that the vertical intensity of penetrating cosmic radiation is > the intensity oblique to the zenith, the mass of air traversed being equiv. in each case (cf. A., 1937, I, 163). This intensity difference occurs with particles penetrating 60 cm. of Pb, but is more pronounced for radiation which passes 10 cm. but not 60 cm. of Pb. Assuming that the effect is due to disintegration of mesotrons, the mean life period is given by $1/W = (4\pm2) \times 10^{-5}$ sec. per 10^9 e.v., where W is the disintegration probability per unit of time and energy. This val. is $\gg$ that calc. from Yukawa's theory assuming a mass of $\sim$200 m for the mesotron.　　　A. J. E. W.

Spontaneous disintegration of " mesotrons," particles composing the penetrating cosmic rays. P. Ehrenfest, jun., and A. Fréon (J. Phys. Radium, 1938, [vii], 9, 529—536).—From the intensity of the penetrating cosmic rays, measured at an altitude, and the recorded intensities at sea level, the mean time of spontaneous disintegration of these rays, supposed to be entirely " mesotrons," has been calc. The val. thus found is not in agreement with the theoretical val. (cf. preceding abstract).　W. R. A.

Barometer effect for cosmic radiation and the mesotron. H. D. Rathgeber (Naturwiss., 1938, 26, 842—843).—An equation connecting the barometer effect for cosmic radiation and the mass absorption of the penetrating component, supposed to be composed of heavy electrons (mesotrons) is obtained. The equation shows that the barometer effect is independent of the const. pressure at the place of origin of the mesotron. The mean dis-

integration path (*i.e.*, the distance traversed by the mesotrons before their no. has been reduced to $1/e$ in consequence of radioactive disintegration) is calc. to be 4 km., and the mean disintegration time is $\sim$0·7 × 10^{-6} sec.　　　A. J. M.

Instability of the barytron and the temperature effect of cosmic rays. P. M. S. Blackett (Physical Rev., 1938, [ii], 54, 973—974).—In gases, owing to the higher ionisation range, so many barytrons decay before being stopped by ionisation that an apparent additional absorption is produced. On a similar basis a detailed explanation of the observed decrease of cosmic-ray intensity with increasing atm. temp. is given.　　　N. M. B.

Models of elementary particles. F. Renner (Naturwiss., 1938, 26, 736—738).—Theoretical. Mechanical models of the electron, neutron, and proton are proposed.　　　A. J. M.

Structure of atomic nuclei. F. J. de Wisniewski (Acta Phys. Polon., 1938, 7, 5—9).—A theory of radiation has been outlined and applied to Li.
　　　W. R. A.

Elastic scattering of Yukawa particles. I. O. Laporte (Physical Rev., 1938, [ii], 54, 905—912).—Mathematical.　　　N. M. B.

Range of nuclear forces in Yukawa's theory. G. C. Wick (Nature, 1938, 142, 993—994).—The demonstration given of Yukawa's fundamental relationship, from which the existence of mesotrons was predicted, is based on Heisenberg's uncertainty principle.　　　L. S. T.

Mesotron (intermediate particle) as a name for the new particles of intermediate mass. C. D. Anderson and S. H. Neddermeyer (Nature, 1938, 142, 878).—The name " mesotron " is suggested for the new particles which have the same electric charge as electrons and protons but an intermediate mass.　　　L. S. T.

Further evidence for the radioactive decay of mesotrons. (A) P. M. S. Blackett. (B) B. Rossi (Nature, 1938, 142, 992, 993).—(A) The mean range of mesotrons is calc. from the relative intensities of the inclined to the vertical cosmic rays, and from the absorption anomaly between air and H_2O. Assuming a mass 150 times that of the electron, the decay time of a fast-moving mesotron is found to be 1·7 × 10^{-6} sec.

(B) Calculations based on the anomaly of absorption of cosmic rays by air and Pb when vertical and inclined counters are used give a val. of $\sim$ 2 × 10^{-6} sec. for the life-time of mesotrons.　　　L. S. T.

Relativistic electron in the crossed field. H. Ott (Ann. Physik, 1938, [v], 33, 584—590).—The relativistic correction for the motion of an electron in crossed magnetic and electric fields is calc.
　　　O. D. S.

Top model of the electron and its application to the probability of radiation by electron-positron pairs. H. Hönl (Ann. Physik, 1938, [v], 33, 565—583; cf. A., 1938, I, 425).　　　O. D. S.

Formation of deuterons by proton combination. H. A. Bethe and C. L. Critchfield (Physical

Rev., 1938, [ii], **54**, 862).—An amplification of considerations previously reported (cf. A., 1938, I, 550).
N. M. B.

Origin of the *E* layer of the ionosphere. S. K. MITRA (Nature, 1938, **142**, 914—915).—Recent work on ionisation of the upper atm. is discussed. The region around 100 km. in which rapid transition of O_2 to O occurs is the region of max. ionisation of O_2, and the ionised layer formed near this level is to be identified with the *E* layer. The origin of this layer is due to strong absorption resulting in photo-ionisation of O_2 commencing at 744 A. L. S. T.

Nuclear magnetic moment of ^{14}N. S. MILLMAN, P. KUSCH, and I. I. RABI (Physical Rev., 1938, [ii], **54**, 968; cf. Bacher, A., 1933, 767).—Using NaCN, KCN, and RbCN, which could be vaporised without decomp., with the new direct measurement mol. beam method (cf. A., 1938, I, 172), the val. found was 0.400 ± 0.002 nuclear magneton, relative to the val. 3.265 for ^7Li (cf. *ibid.*, 293), and in fair agreement with theory (cf. Bethe, A., 1937, I, 163; Feenberg, *ibid.*, 278). N. M. B.

Effect of the development of apparatus and technique on our knowledge of atoms and molecules. M. BODENSTEIN (Naturwiss., 1938, **26**, 833—838).—A lecture. A. J. M.

Closest distance of approach of atoms. B. N. SEN (Gazzetta, 1938, **68**, 656—661; cf. A., 1933, 763).—The formula previously derived has been modified. O. J. W.

Statistical theory of [atomic] nuclei. J. SOLOMON (Compt. rend., 1938, **207**, 910—911).—Limitations of the Thomas–Fermi theory are discussed. A. J. E. W.

Statistical interpretation of the recombination of atomic nuclei. L. GOLDSTEIN (Compt. rend., 1938, **207**, 965—967).—An expression for the probability of recombination of colliding at. nuclei is derived. A. J. E. W.

Neutron–proton interaction. C. W. LAMPSON, D. W. MUELLER, and H. A. BARTON (Physical Rev., 1937, [ii], **51**, 1021).—Neutron–proton encounters in a photographic plate have been investigated. The existence of comparatively long-range forces between the neutron and proton is indicated. L. S. T.

Electron–neutron interaction. S. KIKUCHI and H. AOKI (Nature, 1938, **142**, 832—833).—A correction (cf. A., 1938, I, 169, 289). L. S. T.

Fourier analysis of magnesium and space chemistry of the metals. W. BILTZ (Naturwiss., 1938, **26**, 739).—The results of the Fourier analysis of Mg (A., 1938, I, 430), which indicate that there are in Mg 2 conductivity electrons per atom, are in agreement with space chemistry which divides the at. vol. of Mg (14) into ionic vol. (2) and electron vol. (12). A. J. M.

Symmetry effects in the spacing of nuclear energy levels. J. BARDEEN and E. FEENBERG (Physical Rev., 1938, [ii], **54**, 809—818).—On the basis of Wigner's results on mass defects and stability relations (cf. A., 1937, I, 110, 440) a calculation of level density for intermediate nuclei ($A < 60$), taking into account the dependence of nuclear energies on symmetry character, is made, and level densities for the different nuclear types are tabulated. Results indicate a marked increase of density for increasing isotopic nos. in an isobaric series. N. M. B.

Rigorous theory of interaction between nuclear particles. E. C. G. STUECKELBERG (Physical Rev., 1938, [ii], **54**, 889—892).—Mathematical. N. M. B.

Present status of the value of e/m. R. T. BIRGE (Physical Rev., 1938, [ii], **54**, 972—973).—Data since 1929 are reviewed. Results by six spectroscopic and four non-spectroscopic methods are recalc. with the help of specified auxiliary consts. The most probable val. is $1.7591\pm0.0003 \times 10^7$ e.m.u. N. M. B.

New method of measuring the velocity of light. R. A. HOUSTOUN (Nature, 1938, **142**, 833).—A variation of Fizeau's method in which the toothed wheel is replaced by a piezo-electric quartz oscillator which acts as an intermittent diffraction grating is described. L. S. T.

State of matter in the interior of the planets. R. WILDT (Astrophys. J., 1938, **87**, 508—516).—Speculative. L. S. T.

Lower limit to energy evolution in stellar matter. D. S. KOTHARI (Nature, 1938, **142**, 916).—The min. energy evolved at different [H] by the combination of two protons to form a deuteron is obtained by averaging the probability of reaction for a velocity distribution corresponding with that of a completely degenerate proton gas. L. S. T.

Physical processes in gaseous nebulæ. IV. Mechanistic and equilibrium treatment of nebular statistics. D. H. MENZEL, L. H. ALLER, and J. G. BAKER (Astrophys. J., 1938, **88**, 313—318; cf. A., 1939, I, 6). L. S. T.

Passage of corpuscles through coulombian potential barriers. G. BADARAU (Compt. rend., 1938, **207**, 842—845; cf. *ibid.*, 39).—Mathematical. A. J. E. W.

Transitions between levels spaced almost continuously. A. LANDÉ (Physical Rev., 1938, [ii], **54**, 940—944).—Mathematical. Transition probabilities between closely spaced energy levels are calc. by an approximation method which eliminates the apparent infinities arising in the usual perturbation method. N. M. B.

Bose–Einstein condensation. F. LONDON (Physical Rev., 1938, [ii], **54**, 947—954).—A proof of the condensation phenomenon of a Bose–Einstein gas is given, and the relation of the problem to the λ-point of liquid He is examined (cf. A., 1938, I, 298). N. M. B.

Densities of average magnitude attached to the Dirac electron in the plane monochromatic wave. G. PETIAU (J. Phys. Radium, 1938, [vii], **9**, 451—456).—Mathematical. W. R. A.

Classical wave functions for moving corpuscles. W. E. BENHAM (Phil. Mag., 1938, [vii], **26**, 1031—1049).—Mathematical. W. R. A.

Calculation of phase shifts in scattering problems [in quantum mechanics]. E. L. HILL (Physical Rev., 1937, [ii], **51**, 1023).—Theoretical.
L. S. T.

Cyanogen in stars of less advanced types. (MLLE.) N. MORGULEFF (Compt. rend., 1938, **207**, 967—969).—The CN band at 3590 A. ($^2\Sigma-^2\Sigma$ transition) has been observed in the spectra of a no. of stars in the first subdivisions of the A-type, as well as in more advanced types. A. J. E. W.

Intensity distribution in the bands of cometary spectra. P. SWINGS and M. NICOLET (Astrophys. J., 1938, **88**, 173—181).—The exceptional intensity distribution of bands of unsymmetrical mols. such as CN and CH in these spectra is discussed. L. S. T.

Thermochemistry of isotopes. Absorption spectra and heat of formation of lithium hydride and deuteride. A. F. KAPUSTINSKI, L. M. SCHAMOVSKI, and K. S. BAJUSCHKINA (Acta Physicochim. U.R.S.S., 1937, **7**, 799—810).—The ultra-violet absorption spectra of fine cryst. powders of LiH and LiD have been examined. Absorption max. are at 251·7 and 248·2 mμ., respectively. From these data calc. heats of formation are $\phi_{\text{LiH}} = 22\cdot9$, and $\phi_{\text{LiD}} = 23\cdot6$ kg.-cal. per mol. Thus LiD is more stable than LiH, and this is confirmed by calculation of the respective energies of the crystal lattices.
W. R. A.

Band spectrum of ionised magnesium deuteride. H. JURASZYŃSKA and M. SZULO (Acta Phys. Polon., 1938, **7**, 49—58).—The $^1\Sigma^* \rightarrow \,^1\Sigma$ band system of MgD$^+$ has been investigated. Rotation and vibration consts. have been calc. and compared with those of MgH$^+$. W. R. A.

Kinetics of OH radicals determined by their absorption spectrum. IV. Pressure broadening and the line spectrum as background. O. OLDENBURG and F. F. RIEKE (J. Chem. Physics, 1938, **6**, 779—782).—The [OH] can be determined more easily by using the intensity of the absorption spectrum with an emission line background instead of with a continuous background, provided the pressure broadening is known. At 1473° K. and 1 atm. the total broadening is 0·58 cm.$^{-1}$, of which 36% is Doppler broadening and 64% pressure broadening. On this basis the recent intensity measurements by Avramenko and Kondrateev (A., 1938, I, 553) are re-interpreted and the f vals. ($\sim3 \times 10^{-4}$) agree with previous vals. The applicability of the line spectrum as a background is considered. W. R. A.

Abnormal intensity relations in the band spectrum of indium monoiodide. M. WEHRLI (Helv. Phys. Acta, 1936, **9**, 587—589; Chem. Zentr., 1937, i, 18).—An abnormal intensity distribution occurs for diat. mols. when equal interat. distances in two electronic states correspond with different vibrational vv. In such cases $v'' - v' = \pm2n$, v'' and v' being the vibrational quantum nos. for the two states. This rule is confirmed for GaI, BCl, and BBr, and particularly for InI, where data for high quantum nos. are available. A. J. E. W.

Ultra-violet absorption bands ascribed to nitrous acid. D. M. NEWITT and L. E. OUTRIDGE (J. Chem. Physics, 1938, **6**, 752—754).—The series of absorption bands obtained by Melvin and Wulf (A., 1936, 135) for a NO–NO$_2$–H$_2$O mixture at room temp. is very similar to that obtained by Bone and Newitt (A., 1927, 631) from the explosion of a CO–H$_2$O–NO mixture at high pressures. The same spectrum is obtained from CO explosions at atm. pressure and from stationary flames burning in various media containing N$_2$O and NO. The suggested origin of the spectrum is the selective enhancement of certain NO$_2$ absorption bands rather than to HONO as suggested by Melvin and Wulf. W. R. A.

Absorption of carbon disulphide vapour in the Schumann region. E. HAUPTMAN (Acta Phys. Polon., 1938, **7**, 86—94).—From the absorption spectrum in the Schumann region the vals. of the fundamental vv of CS$_2$ have been obtained and are compared with infra-red and Raman data. Three other separations of 869 ($\nu_3 - \nu_1$), 1326, and 803 cm.$^{-1}$ are reported but the last two cannot be assigned.
W. R. A.

Absorption spectra and chemical processes in gas discharges. N. PRILESHAEVA and H. NOETHER (Acta Physiocochim. U.R.S.S., 1937, **7**, 811—824).—Chemical processes can conveniently be studied by examination of absorption spectra, together with the emission spectra during the reaction and the fluorescence spectra of the end products. In this way several org. reactions have been studied in the high-frequency discharge. W. R. A.

Molecular resonance systems. VII. Different ionisation steps of indophenols and indamines and their absorption spectra. G. SCHWARZENBACH, H. MOHLER, and J. SORGE (Helv. Chim. Acta, 1938, **21**, 1636—1645; cf. A., 1937, II, 385).—The absorption spectra of solutions of compounds of the type X·C$_6$H$_4$·N·C$_6$H$_4$·X (where X = NMe$_2$ or OH) have been determined at various p_H. Symmetrical and asymmetrical arrangements of the mols. or ions are detectable by their absorption in longer and shorter λ regions, respectively, and hence the various ionic states are postulated, and their ionisation consts. determined. The addition of a proton to the central N has little effect on the absorption spectrum. J. W. S.

Tautomerism and mesomerism of the carbamyl group and their relation to light absorption; *o*- and *p*-hydroxyazo-compounds.—See A., 1939, II, 36.

Spectrographic investigation of the " active " forms of 9 : 10-diphenylanthracene. Spectrographic studies by means of corrected Hartley figures : *meso*-derivatives of anthracene.—See A., 1939, II, 55.

Absorption spectra of organic substances in concentrated sulphuric acid. IV. Heterocyclic compounds. F. BANDOW (Biochem. Z., 1938, **299**, 199—221; cf. A., 1938, I, 493).—Curves have been plotted for indole, tryptophan, uric acid, adenine, hæmin, bilirubin, creatine, creatinine, quinine, vitamin-B_1 and -B_2, C$_5$H$_5$N, quinoline, and dibenzacridine and for many other substances of similar constitution or having similar biological properties. The absorption

of many of the substances in conc. H_2SO_4 is very similar to that in org. solvents but in some cases H_2SO_4 causes production of new bands or flattening of the curve.   W. McC.

Reducing sugars. V. W. BEDNARCZYK and L. MARCHLEWSKI (Biochem. Z., 1938, **300**, 42—45; cf. A., 1933, 1278).—Mol. extinction curves for sorbose and glucosone have been determined. The former selectively absorbs light of short λ, the max. absorption being at 278 to 280 mμ. Ketoses in contrast to aldoses appear to exist in aq. solution partly as the free ketones. Glucosone shows definite selective absorption.   J. N. A.

Absorption of light of short wave-length by indirubin and indigotin. J. CHOLEWINSKI and L. MARCHLEWSKI (Biochem. Z., 1938, **300**, 56—58).—With indirubin in alcohol, the mol. extinction curve shows 3 max. and 4 min., whilst in $CHCl_3$ there is a similar type of curve, but with only 2 max. and 3 min. The mol. extinction curve of indigotin in $CHCl_3$ shows 2 max. and 1 min.   J. N. A.

Visible absorption spectra of porphin and its isomeride. V. M. ALBERS and H. V. KNORR (Physical Rev., 1937, [ii], **51**, 1017).—Except for a shift in λ of 100 A. towards the red, the general pattern of the absorption spectrum of *iso*porphin is similar to that of porphin (I). The absorption coeffs. in the bands are approx. one third of those for (I).   L. S. T.

Intensity distribution in " wings " of a Rayleigh line from carbon disulphide, chloroform, and carbon tetrachloride. J. PNIEWSKI (Acta Phys. Polon., 1938, **7**, 186—195).—The Rayleigh scattering of the 4358 A. Hg line by CS_2, $CHCl_3$, and CCl_4 has been examined. The intensity distribution of the " wings " close to the Rayleigh line is not in agreement with the rotation theory. It is doubtful whether the rotation of the mol. can be regarded as the principal origin of both the inner and outer parts of the " wings."   J. A. K.

Raman effect and its applications in inorganic chemistry. XIV. A. SIMON (Angew. Chem., 1938, **51**, 783—795, 808—815).—A review. Recent developments in the theory of Raman spectra and in measurement technique are summarised, and their application to the determination of the structure of inorg. mols. and ions is discussed.   J. W. S.

Raman spectrum of nitrogen. C. E. MILLER (J. Chem. Physics, 1938, **6**, 902—904).—Using N_2 at 4 atm. and a 20 hr. exposure good spectrograms were obtained which showed up the rotational Raman spectrum. In spite of this the nuclear spin of ^{15}N could not be determined because of the very large no. of lines arising from ^{14}N–^{14}N, ^{14}N–^{15}N, and ^{15}N–^{15}N. The intensity relations are compared with those predicted from the theory of Placzek and Teller. All the lines from $J = 2$ to 18 have been observed and are in good agreement with calc. vals. The $0 \rightarrow 1$ vibration frequency is 2328·3 cm.$^{-1}$ W. R. A.

Raman effect of sulphuric acid solutions in methyl and ethyl alcohol. M. S. ASCHKINAZI and P. V. KURNOSOVA (J. Phys. Chem. Russ., 1938, **11**, 848—851).—Two of the Raman lines of MeOH and

EtOH are altered by H_2SO_4, and all lines of H_2SO_4 are affected by the alcohols. Presumably $MeO \cdot SO_3'$ or $EtO \cdot SO_3'$ is formed.   J. J. B.

Raman effect in non-aqueous solutions of antimony trichloride. III. P. V. KURNOSOVA and M. S. ASCHKINAZI (J. Phys. Chem. Russ., 1938, **11**, 844—847; cf. A., 1936, 1459).—The spectra of $SbCl_3$ in PhMe and EtBr contain no lines which can be ascribed to complex formation; the 320 cm.$^{-1}$ line of $SbCl_3$ is shifted to 334 cm.$^{-1}$ J. J. B.

Raman effect of dibromofluoromethane. G. GLOCKLER and J. H. BACHMANN (Physical Rev., 1938, [ii], **54**, 970—971).—Data for 9 Raman shifts are tabulated. The sample undergoes photochemical decomp.   N. M. B.

Raman spectra of deuteroethyl and deuteroethylene bromides. M. DE HEMPTINNE and C. VELGHE (Physica, 1938, **5**, 958—960).—The Raman spectra of $(CH_2Br)_2$, $CH_2Br \cdot CHDBr$, $(CHDBr)_2$, $(CD_2Br)_2$, EtBr, $CH_2D \cdot CH_2Br$, CHDMeBr, $CHD_2 \cdot CD_2Br$, and C_2D_5Br have been determined. The lines for deuteroethyl bromides are mostly doublets, indicating the existence of isomerides.   A. J. M.

Raman frequency variations of ethylenic linkings in cyclic hydrocarbons. G. CHIURDOGLU and A. GUILLEMONAT (Bull. Soc. chim., 1938, [v], **5**, 1624—1628).—The frequency due to the double linking is increased if radicals, especially Me, are introduced at the double linking, a second substitution raising the frequency still further. Substitution in the α and β positions respectively lowers and raises the frequency.   C. R. H.

Infra-red luminescence emission of some rare-[earth] elements. M. SERVIGNE (Compt. rend., 1938, **207**, 905—907).—Cathodo-luminescence spectra of Eu, Sm, and Dy compounds in solid solution in $CaWO_4$ (6000—10,000 A.) are reproduced. The spectra differ from those obtained with solid solutions in $CaSO_4$ (A., 1933, 660). A new Sm band system ($\sim$9476 A.) is reported. Nd, Tb, Ho, Er, and Tu give no characteristic emission.   A. J. E. W.

Breakdown of zinc sulphide by light and α-rays. E. STRECK (Ann. Physik, 1939, [v], **34**, 96—112).—The decrease in the phosphorescence and the change in the dielectric const. of radioactivated ZnS phosphors with time have been followed. The effect of binding material, and of H_2O, CO_2, and HCl vapours, on the blackening of ZnS phosphors by light has been investigated. After change in dielectric const. by exposure to light, the original val. is regained on keeping in the dark. Blackening by light followed be regeneration in the dark has been observed in pure, unannealed ZnS.   O. D. S.

Electrical investigation of zinc sulphide–copper phosphors. F. GOOS (Ann. Physik, 1939, [v], **34**, 77—95).—The change in dielectric const. and conductivity of ZnS–Cu phosphors on illumination has been investigated. The conductivity effect shows an important dependence on the thickness of the film. The effect of breaking down by light and by α-rays on the electrical properties of the phosphor has been investigated. A rectifier effect of thin layers of

phosphor for current parallel to the direction of illumination is described.   O. D. S.

New method for measuring the decay of phosphorescence and its application to the ZnS-CdS-Cu phosphor on excitation by an electron beam. G. WOLLWEBER (Ann. Physik, 1939, [v], **34**, 29—40).—The decay of phosphorescence is followed by registration of the dielectric const. of the phosphor. The variation in the time of phosphorescence of ZnS-CdS-Cu phosphors with [Cu], with ratio of ZnS to CdS, with oxidation, and with age has been investigated.   O. D. S.

Origin of the infra-red telluric absorption band q_2. A. ADEL (Astrophys. J., 1938, **88**, 200—201).—The telluric absorption band at 12·65 μ. is shown to be a member of the group of CO_2 bands which determine the infra-red limit of atm. transmission.   L. S. T.

Analysis of the infra-red limit of atmospheric transmission. A. ADEL and C. O. LAMPLAND (Astrophys. J., 1938, **88**, 182—185).—The correspondence between the related set of CO_2 bands at 15 μ. and the infra-red limit of atm. transmission is discussed.   L. S. T.

The rock-salt prismatic solar spectrum. A. ADEL (Astrophys. J., 1938, **88**, 186—188).— Further details in this spectrum have been obtained. The envelope structure of the O_3 band at 9·6 μ. is that of a doublet, whilst additional absorption bands near the diverging wall of the H_2O band ν_2, in the region 7·2 to 8·5 μ., may indicate the existence of N_2O and N_2O_5 in the atm.   L. S. T.

Far infra-red absorption of atmospheric water vapour. W. M. ELSASSER (Astrophys. J., 1938, **87**, 497—507).—The absorption of radiation caused by the rotational H_2O band is discussed, using the data of Randall et al. (A., 1937, I, 495). A formula expressing the mean fraction of radiation absorbed is given for λλ <33 μ.   L. S. T.

Position of the first overtone of the hydrogen link. H. HOYER and T. FÖRSTER (Naturwiss., 1938, **26**, 774).—The absorption spectra of o-OH·C_6H_4·NO_2 and o-OD·C_6H_4·NO_2 in CCl_4 have been investigated. The H-compound absorbs considerably more strongly than the D-compound over the whole range. The difference between the two extinction coeffs. shows very strong max. at 1·65 and 2·27 μ., which are to be accounted for by the presence of the OH group. The max. at 1·65 μ. corresponds with the first overtone of OH. It is displaced to longer λλ under the influence of the H-binding and is considerably broadened.   A. J. M.

Association of unlike molecules through hydrogen bonds. W. GORDY (Nature, 1938, **142**, 831).—Curves showing the existence of an association band in the region of 4 μ. for mixtures of $CHCl_3$ and $COMe_2$ are reproduced. Mixtures of $CHCl_3$ with Et_2O and C_5H_5N give a similar band, which is regarded as an NH or OH vibrational band resulting from a H linking formed by the sharing of a proton of the CH group of $CHCl_3$ with the N or O of the solvent. A similar, but weaker, band has been found for some $CHBr_3$ solutions.   L. S. T.

Researches on intra- and inter-molecular links by infra-red absorption spectra. I. Hydroxyl bands. R. FREYMANN (J. Phys. Radium, 1938, [vii], **9**, 517—524).—A review.   W. R. A.

Reactivity of lower hydrocarbons. I. Preparations and infra-red spectra of methanes and ethanes. II. Extinction coefficients of deuteromethanes and deuteroethane and their mode of analysis. Activation of specific bonds in (III) methane, (IV) ethane, (V) propane, and (VI) ethylene, on catalytic surfaces. K. MORIKAWA (J. Soc. Chem. Ind. Japan, 1938, **41**, 341—342B, 342—343B, 343—345B, 345—347B, 347—350B, 350—351B).—Résumés of work already noted (A., 1936, 1213, 1346; 1937, 1, 418; 11, 131).   W. R. A.

Infra-red bands of methylamine and the phenomenon of free rotation. H. W. THOMPSON and H. A. SKINNER (J. Chem. Physics, 1938, **6**, 775—778).—NH_2Me, like MeOH, is an unsymmetrical top mol. which shows close resemblance to the symmetrical top mol., C_2H_6, and all three possess an axis around which free rotation may occur. Columns of gaseous NH_2Me of 5·5 and 13 m. have been examined at pressures up to 1 atm. in the region 7000 to 11,000 A. and give two bands at 10,300 A. (B) and 9940 A. (A). The former, which is ~100—150 cm.⁻¹ broad, shows no rotational structure nor P, Q, and R contours. (B) consists of a group of approx. equidistant rotational lines about 5 A. apart although the spacing is irregular. (A) is 3 ν_{NH} and (B) is probably 3 ν_{CH} + ν_{CN}. Evidence is adduced in favour of slight free rotation and of a structure closely approximating to a rigid symmetrical top.   W. R. A.

Infra-red absorption of carboxylic acids in solution. I. Qualitative features. II. Intensities. M. M. DAVIES and G. B. B. M. SUTHERLAND (J. Chem. Physics, 1938, **6**, 755—766, 767—770).— I. Partly an extension of work already noted (A., 1938, I, 227). Solutions of AcOH, BzOH, and CCl_3·CO_2H in CCl_4 have been studied, at various concns. and temp., near 2·6—3·4 μ., 5·6—6·2 μ., and 6·7—8·0 μ., where absorption arises respectively from the O·H, the C:O, and the C·O linkings of the CO_2H. At each position double bands appear, one of which is due to the monomeric and the other to the dimeric form of the mol. The smallness of the shift indicates that little change is brought about in the mol. by association. In the region near 6 μ. 0·010M-AcOH gives two bands at room temp. and at 73·5° with centres at 5·66, 5·82 and at 5·64, 5·81 μ., respectively. At the lower temp. the longer-λ band is much the more intense, but at 73·5° their intensities are comparable. For a 0·0020M. solution the 5·65 μ. band was stronger than that at 5·81 μ. In the region of 7 μ. 0·01M-AcOH at 18° gave bands at 6·94, 7·05, 7·25, and 7·75 μ., whilst at 73·5° the band at 7·25 μ. becomes more intense, the 6·94 μ. less intense, and the 7·05 and 7·75 μ. bands remain unchanged. CCl_3·CO_2H at 18° gave strong bands at 6·98, 7·06, and 7·85 μ., and weak bands at 6·82 and 7·36 μ. At 73·5° 6·98 μ. seemed to disappear and a new band was found at 7·2 μ. The behaviour of the O·H band in acids and in alcohols is compared and a strong similarity is shown. Bond distances for each bond studied have been estimated

for the monomeride and for the dimeride and compared with available data.

II. The integrated intensity of the absorption of the monomeric OH band has been measured for CCl_4 solutions of AcOH, BzOH, and lauric acid and at any temp. is approx. $\propto$ the monomeride concn., assuming that there is monomeride $\rightleftharpoons$ dimeride equilibrium. From the temp. variation of integrated absorption the heat of association is 6000—10,000 g.-cal. per mol., which is $\ll$ the accepted val., 15,000 g.-cal. The difference is attributed to variation of absorption coeff. with temp. Similar anomalous results are given by the monomeric C:O band. Variations of the absorption coeff. with concn. and with temp. were checked independently on solutions of cetyl alcohol in CCl_4. W. R. A.

Infra-red study of ω-hydroxyundecoic acid in carbon tetrachloride. M. M. DAVIES (J. Chem. Physics, 1938, 6, 770—774).—CCl_4 solutions of the acid (I) at 74° in the region 2·6—3·5 μ. give distinct sharp bands with peaks at 2·755 and 2·835 μ. corresponding with the alcoholic and carboxylic O·H absorptions, respectively. From a study of the integrated absorption, estimates of molar concn. of free alcoholic O·H groups in (I) have been made. The fraction of free O·H, approx. one half of their stoicheiometric amount at higher concns., increases with dilution and subsequently decreases. The degree of association at 0·125M. is ~2·7. The first kind of association is

$$OH\cdot CH_2\cdot [CH_2]_9\cdot C \overset{O----H----O}{\underset{O----H----O}{<}} \overset{}{>} C\cdot [CH_2]_9\cdot CH_2\cdot OH$$

(A) followed by association involving the alcoholic OH group, viz.,

$CO_2H\cdot [CH_2]_9\cdot CH_2(OH)–HO\cdot H_2C\cdot [CH_2]_9\cdot CO_2(HB')$ and $CO_2H\cdot [CH_2]_9\cdot CH_2(OH)–CO_2H\cdot [CH_2]_9\cdot CH_2\cdot OH$ (B'').
Assuming that (B') + (B'') are as frequent as (A) associations at the dimeric stage, increased dilution should cause a progressive increase in free alcoholic OH but since this does not occur intramol. interaction in the monomeride is postulated. The computed vals. of free OH suggest that the monomeride is an equilibrium mixture of open-chain and cyclic mols., being 70% cyclic. A similar analysis of carboxylic O·H absorption (2·835 μ.) has been carried out. The proportion of free carboxylic OH groups is $<$ that of free alcoholic OH groups, supporting the view that association (A) takes place first. There is no evidence of the " parallel " association, $\begin{Bmatrix} CO_2H\cdot [CH_2]_9\cdot CH_2\cdot OH \\ CO_2H\cdot [CH_2]_9\cdot CH_2\cdot OH \end{Bmatrix}$. The results substantiate the conclusions regarding the behaviour of (I) which were arrived at from kinetic considerations (A., 1938, I, 257). W. R. A.

Comparison of the infra-red absorption spectra of heterocyclic compounds and homocyclic hydrocarbons. L. LECOMTE (J. Phys. Radium, 1938, [vii], 9, 512—516).—A detailed account of work already noted (cf. A., 1938, I, 494) in the region 500 to 1300 cm.$^{-1}$ W. R. A.

Absorption spectra of monosubstitution products of benzene in the far infra-red from 180 to 600 cm.$^{-1}$ (17—55 μ.). P. BARCHEWITZ and M. PARODI (Compt. rend., 1938, 207, 903—905; cf. A., 1938, I, 228).—λλ of bands in the diffusion and absorption spectra of PhX (X = H, Me, NH_2, CN, OMe, NO_2, Cl, Br, and I) are recorded. The attribution of these bands to ω_1, ω_2, ω_{10}, and ω_{12} vibrations is discussed. A. J. E. W.

Polarisation of ions in non-uniform field and calculation of the dissociation energy of ionic molecules. S. J. PSCHESHETZKI (J. Phys. Chem. Russ., 1938, 11, 793—800).—Polarisation of anions by cations at various mutual distances is calc. From the experimental data for distances in KCl and similar mols. the repulsive forces between the ions are calc.. The polarisability in uniform field gives nearly correct vals. for the dipole moments of KCl, KBr, KI, and CsI. J. J. B.

Surface migration of barium. M. BENJAMIN and R. O. JENKINS (Phil. Mag., 1938, [vii], 26, 1049—1062).—The migration of Ba over W and Ni has been investigated by three methods : (i) a Ni surface was provided with a step which acted as a barrier to evaporating material and the behaviour of a layer of emitting oxide was investigated by the electron microscope method (A., 1938, I, 337), (ii) Ba was deposited on one side of strips of Ni and of W and the thermionic emission from each side was measured, (iii) Ba and Th were deposited on one side of a W wire and the movements of the deposited layers were observed in a one-dimensional microscope. Under similar vac. conditions Th, but not Ba, migrates over W and the Ba film appears to be quite stable until evaporation occurs for both Ni and W. W. R. A.

Contact difference in potential between barium and magnesium. R. J. CASHMAN (Physical Rev., 1938, [ii], 54, 971).—A discussion and amplification of the results of Anderson (cf. A., 1939, I, 9). N. M. B.

Semi-conductor theory of the boundary layer. W. SCHOTTKY (Naturwiss., 1938, 26, 843).—The theory that the unipolar conductivity of a rectifier of the Cu_2O type is due to changes in the density of the conductivity electrons in the interfacial zone between the metal and semi-conductor has been further extended. The theory leads to quant. results which are in agreement with experimental data for both surface and point detectors. A. J. M.

Interaction of conductivity electrons and distortion centres in electronic semi-conductors. Potential and frequency effects. F. H. MÜLLER (Naturwiss., 1938, 26, 739—740).—The energy coupling of conductivity electrons in the distortion spaces of semi-conductors may be regarded as analogous to the formation of ionic clouds in aq. solutions of electrolytes. This assumption gives an explanation of the potential effect (Waibel, A., 1937, I, 114). The dispersion of conductivity of electrolytes at high frequency may be expected to have its counterpart in semi-conductors. A. J. M.

Photoconductivity in willemite. R. HOFSTADTER (Physical Rev., 1938, [ii], 54, 864).—The photoelectric response curves for two specimens of mineral exposed to radiation of λλ 2500—3500 A. are given and discussed. N. M. B.

Electric currents and reverse potentials in paraffin irradiated with X-rays. W. SCISLOWSKI

(Acta Phys. Polon., 1938, **7**, 127—158).—The conduction of electricity through paraffin wax during and after exposure to X-rays has been studied. X-Rays produced a considerable increase of conductivity similar to that found previously with γ-rays. The current–time and current–potential curves were complicated by a back-e.m.f. J. A. K.

Dielectric polarisation of formic acid vapour. I. E. COOP, N. R. DAVIDSON, and L. E. SUTTON (J. Chem. Physics, 1938, **6**, 905).—Using an apparatus previously described (A., 1938, I, 557), the dielectric polarisation of HCO_2H vapour as a function of pressure has been measured between 37·5° and 127°. From the relation $P = P_1 f_1 + P_2 f_2$ (P = apparent polarisation at mole fractions f_1 and f_2 of monomeride and dimeride respectively calc. from v.p. data), P_1 (monomeride) and P_2 (dimeride) have been determined separately up to 74·2°. P_1 appears to increase with temp. (max. at 70°) and then to diminish, suggesting a transition from one state to another with higher energy and higher dipole moment. The nature and consequences of such a transition on the infra-red spectrum of monomeric HCO_2H at different temp. and on the zero-point energy are indicated. P_2 is either const. or increases with rise of temp. The results are not in agreement with those of Zahn (A., 1931, 895). W. R. A.

Apparent dipole moment of hexamethylene-tetramine in chloroform solution. R. J. W. LE FÈVRE and G. J. RAYNER (J.C.S., 1938, 1921—1925).—Dipole moment measurements indicate that $(CH_2)_6N_4$ (I) in $CHCl_3$ solution is non-polar, and therefore symmetrical. Of the three symmetrical models previously advanced that of Dominikiewicz is improbable since it contains a quadrupole with charges so distributed on the 4 N atoms that anomalous polarisation effects would be expected. Dipole moment data do not decide unequivocally between the other two. Raman spectra of (I) in H_2O and in $CHCl_3$ were found to be identical, indicating that (I) is essentially the same in both solvents. Further the close similarity between the Raman spectrum of (I) and that of *cyclo*hexane suggests that the mol. consists of six-membered rings. The formula proposed by Duden and Scharff is preferred to that containing two 4- and one 8-membered rings proposed by van 't Hoff. W. R. A.

Mobile rings in anisotropic drops of *p*-azoxy-anisole containing a small amount of phloridzin. P. GAUBERT (Compt. rend., 1938, **207**, 1052—1054).—The optical properties of the rings in *p*-azoxyanisole, containing 1 in 150 to 1 in 20 of phloridzin, have been investigated. Different behaviours are exhibited by drops formed respectively (i) by fusion of solid or (ii) by cooling a liquid melt. The mobility of rings formed by (i) is more easily observable than for those formed by (ii). Tentative explanations of the observed phenomena are given (cf. A., 1938, I, 300). W. R. A.

Optical activity of secondary butyl alcohol. E. GORIN, J. WALTER, and H. EYRING (J. Chem. Physics, 1938, **6**, 824—832).—The optical activity of *sec.*-BuOH has been calc. on a one-electron model. W. R. A.

Specific magnetic rotatory power of dissolved ferric nitrate and of a ceric sulphate. H. OLLIVIER (Compt. rend., 1938, **207**, 983—985).—The sp. magnetic rotatory power (G) of aq. $Fe(NO_3)_3$ (I) containing HNO_3 is negative [$-14\cdot2$ and $-27\cdot3 \times 10^{-3}$ for 33% (I) at ~6540 and 5140 A., respectively]; $-1/G$ increases slowly with rising temp. between 0° and 38°, and then remains const. The virtual Curie point is $-350°$ K. These results point to the existence of a complex ion in (I) solutions. Solutions of yellow $Ce(SO_4)_2$ in dil. H_2SO_4 obey the Weiss law and resemble $Ce_2(SO_4)_3$ solutions in magnetic behaviour, suggesting that CeO_2 is $O:O:Ce\cdot Ce:O:O.$ A. J. E. W.

Simplified writing of electronic formulæ. P. BAUMGARTEN (Ber., 1938, **71**, [*B*], 2606—2607).—The methods of Lewis, Robinson, and the author (A., 1938, I, 122) are discussed and compared. F. L. U.

Free radical terminology. S. T. BOWDEN (Nature, 1938, **142**, 879).—Attention is directed to the confusion arising from an incorrect use of the term diradical. Since the terms " odd mol." and " even mol." have lost much of their significance, it is suggested that a mol. which is both an ion and a free radical should be called an " ion-radical." L. S. T.

Natural periodic system of the non-ionic compounds. II. J. N. FRERS (Z. anorg. Chem., 1938, **240**, 1—14).—Theoretical. In the light of the systemisation already described (A., 1930, 400) some recent results on the intensities of Raman lines and on X-ray absorption edges in certain series of compounds, and also the relative stabilities of certain complex ions and the stoicheiometry of intermetallic compounds of the alkali metals with Hg, are discussed. F. J. G.

Maximum valency of elements and atomic structure. XI. Formation of chemical compounds and the periodic system. B. ORMONT (Acta Physicochim. U.R.S.S., 1938, **8**, 811—847; cf. A., 1937, I, 222).—In part a historical survey. The author emphasises the need of introducing into current conceptions of the structure of compounds and elements a no. of corrections which are considered in detail in this and previous papers. The influence of i-electrons on the magnitude of the valency angle in compounds is discussed. F. L. U.

Formation of compounds of univalent iron, cobalt, nickel, manganese, and other metals. B. ORMONT (Acta Physicochim. U.R.S.S., 1938, **8**, 848—856).—The nature of compounds such as $Fe(NO)_2SK$, $K_2Co(CN)_3$, $K_2Ni(CN)_3$, and $K_5Mn(CN)_6$ is discussed, and reasons against their formulation as derivatives of a univalent central atom are given. Complex cyanides are considered in the light of the author's selection rule. F. L. U.

Constitution of complex metallic salts. VIII. Bridged thio-derivatives of palladous halides with tertiary phosphorus. J. CHATT and F. G. MANN. **IX. Oxalate radical as a " bridging group " between metallic atoms. Structure and reactions of dichlorobistri-*n*-butylphosphine-*μ*-oxalatodipalladium.** J. CHATT, F. G. MANN, and A. F. WELLS (J.C.S., 1938, 1949—1954, 2086—

2093).—The bridged *derivatives*, $[(R_3X)PdCl_2]_2$, X = P or As, exist in the solid state in only one of three possible isomeric structures which, in org. solvents, are all present in tautomeric equilibrium (A., 1938, I, 388). This entails the facile intramol. wandering of the phosphine (or arsine) mols. and of the unbridged terminal halogen atoms. Certain org. thiol and dithiol derivatives have been examined to determine whether bridging acid radicals are firmly held in the central ring or whether they can migrate about the mol. When $[(Bu^a{}_3P)PdCl_2]_2$ (I) is treated with 1 mol. of EtSH the trichloromonoethylthiol compound, $[(Bu^a{}_3P)_2Pd_2Cl_3(SEt)]$ (II), is formed; on addition of even a large excess of EtSH only the dichlorobis-ethylthiol compound, $[Bu^a{}_3P,PdCl(SEt)]_2$ (III), is formed. Evidence is given that the SEt groups bridge the Pd atoms. Although the $Pd(SEt)_2Pd$ is more stable than the $PdCl_2Pd$ ring the SEt radicals readily migrate. This is shown by the fact that, in org. solvents, (II) is partly converted into an equilibrium mixture of (III) and (I). Therefore, in org. solvents, (i) a compound of this type may exist not only in tautomeric equilibrium with isomeric forms but also in equilibrium with other similar but distinct compounds, and (ii) the bridged and unbridged groups are free to migrate. Attempts to prepare the unbridged bisethylthiol compound, $[(Bu^a{}_3P)_2Pd(SEt)_2]$, in a cryst. form were unsuccessful. Crystals of (II) should exist in two forms but crystallographic evidence shows that they are homogeneous. The properties of similar thiocyanate and o-phenylenedithiol derivatives are discussed. The $Pd(SEt)_2Pd$ ring is more stable than the $Pd(SCN)_2Pd$ ring as indicated by comparison of their reactions with 2 : 2′-dipyridyl and with p-$C_6H_4Me\cdot NH_2$. The following are described : *dichlorobis(tri-n-butylphosphine)-µ-bisethylthioldipalladium* [= (III) above], deep yellow, m.p. 115—116°, moderately sol. in cold EtOH, very sol. in C_6H_6, unaffected by 2 : 2′-dipyridyl, p-$C_6H_4Me\cdot NH_2$, or excess of EtSH ; *dichlorobis(tri-n-butylphosphine)-µ-monochloromonoethylthioldipalladium* [= (II) above], yellow, slightly sol. in EtOH and in C_6H_6 ; *4-chloro-o-phenylenedithiolbis(tri-n-butylphosphine)-µ-4-chloro-o-phenylenedithioldipalladium*, $[(Bu^a{}_3P)_2Pd(S_2C_6H_3Cl)Pd\colon S_2C_6H_3Cl]$, red, m.p. 114° ; *4-chloro-o-phenylenedithiolbis(tri-n-butylphosphine)palladium*, $[(Bu^a{}_3P)Pd\colon S_2C_6H_3Cl]$, buff, m.p. 116°.

IX. From dipole moment measurements Finn concluded that in the dichloro-oxalate compound, $[(Bu^a{}_3P)_2Pd_2Cl_2C_2O_4]$ (IV), the Pd atoms were bridged by the oxalate group, whereas Mann and Purdie (A., 1936, 1496), from chemical evidence, considered that the Cl atoms formed the bridge. With a Cl bridge the Pd atoms should be $\sim 3\cdot 4$ A. apart, whilst with an oxalate bridge they should be $\sim 5\cdot 3$ A. apart. *X*-Ray examination of crystals of (IV) gives a Pd—Pd distance of $\sim 5\cdot 48$ A., two mols. per cell, space-group $P2_1/c$, and a centre of symmetry. The mol. therefore has the structure
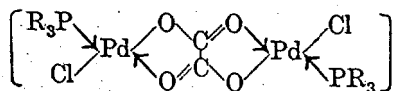
Chemical evidence in support of this formulation is also given. (IV) has been prepared by an improved method and its reactions with p-$C_6H_4Me\cdot NH_2$ and with EtSH are discussed. The prep. of *oxalatobis-n-butylphosphinepalladium*, $[(Bu^a{}_3P)_2PdC_2O_4]$ (V), and *dichlorobis-p-toluidinepalladium*, $[(C_6H_4Me\cdot NH_2)_2PdCl_2]$, is given. The colourless thread-like crystals of (V), m.p. 175—180° (decomp.) after previous darkening at 170—175°, are very sol. in EtOH and C_6H_6, almost insol. in *cyclo*hexane ; the action of $(NH_4)_2[PdCl_4]$ and of $Ca[PdCl_4]$ on (V) is discussed. W. R. A.

Configuration of chelate rings. H. J. TRESS (Chem. and Ind., 1938, 1234—1235).—The principle that chelate groups of atoms (*e.g.*, the oxalate radical) span *cis* valency bonds of the central atom can also be deduced from the isomerism of certain types of complex compounds involving 1 and 2 chelate rings in the complexes. W. R. A.

Calculation of bond strengths from photochemical evidence. M. BURTON (J. Chem. Physics, 1938, **6**, 818—823).—The principle that, when a multivalent mol. predissociates with a sudden broadening of the rotational lines of a discrete absorption spectrum, there should be a close correspondence between the beginning of the predissociation region and the strength of the ruptured bond has been used to calculate the C·C bond strengths in C_2H_6, MeCHO, $COMe_2$, and free Ac, and the C·H bond strengths in CH_4, MeCHO, CH_2O, and free CHO radicals. Bond strengths are defined as the difference between the lowest energy state of the compound and the total lowest energy of the products formed by the rupture of the particular bond, both calc. with reference to the state of the mol. at 0° K. The implications and limitations of the method and results are considered. W. R. A.

Internal rotation of propane and propylene ; origin of the internal restricting potentials. G. B. KISTIAKOWSKY, J. R. LACHER, and W. W. RANSOM (J. Chem. Physics, 1938, **6**, 900—901). Using the "hot wire" technique the internal potentials of C_3H_8 and C_3H_6 are respectively 3200—3600 and 600—800 g.-cal. per Me group. Restricting potentials are due to an interaction of electron pairs forming single bonds on adjacent multivalent atoms but electron pairs forming double bonds do not take part in this orienting interaction. This hypothesis is used to examine existing data on C_2H_6, $COMe_2$, $Pr^\beta OH$, CMe_4, MeOH, EtOH, NH_2Me, and $(CHCl)_2$. W. R. A.

Calculation of internuclear distances, energies of separation, and atomic refraction. E. L. LEDERER (Acta Phys. Polon., 1938, **7**, 110—124).—The author's simple equations are shown to give good agreement with the experimental vals. for a large no. of polar and non-polar compounds. J. A. K.

Relation between the force constant, internuclear distance, and the heat of rupture of a linkage. J. J. FOX and A. E. MARTIN (J.C.S., 1938, 2106—2109).—From force const. data derived from spectroscopic observations it is permissible to assume that all C·H linkages have the same heat of rupture, and, on this assumption, the heats of rupture of various C·C linkages have been evaluated. When the linkage heats are combined additively good

agreement is obtained with the observed vals. for C_2H_6, C_6H_6, PhMe, p-xylene, and mesitylene. The plot of heat of rupture of different C·C linkages against internuclear separation is a smooth curve. The calculation of internuclear distances from heats of formation and the relation between heat of rupture of a linkage and bond order are also discussed.

W. R. A.

Electronic network in compounds of multiple ionisation. R. FORRER (J. Phys. Radium, 1938, [vii], **9**, 411—418; cf. A., 1938, I, 602; 1939, I, 6).—The electronic network in compounds of multiple ionisation, for which the usual contact law $T = F\sqrt{N}$ is valid, has been determined. The orbital interaction $F \propto i$, the degree of ionisation. The m.p. of different compounds with similar cryst. state and the same no. N of contacts also $\propto i$; this is verified by reference to KCl, CoO, TiN, and TaC. The electronic structure of graphite is elucidated by treating it as a compound of quadruple ionisation, by analogy with BN.

W. R. A.

Interatomic forces in metals. L. PAULING (Physical Rev., 1938, [ii], **54**, 899—904).—Evidence is presented that 2·56 of the total of five d orbitals are involved in bond formation, through hybridisation with the $4s$ and $4p$ orbitals, and that the no. of covalent bonds resonating among the available interat. positions increases from one to nearly 6 in the sequence K, Ca, Sc, Ti, V, Cr, remains nearly const. from Cr to Ni, and begins to decrease with Cu. The remaining 2·44 d orbitals, with very small interat. overlapping, are occupied by non-bonding electrons which are mainly responsible for the ferro- and para-magnetic properties of the metals. These views provide a qual. explanation of many properties of the transition and ferromagnetic elements.

N. M. B.

Active states of solid matter and their significance in inorganic chemistry. R. FRICKE (Angew. Chem., 1938, **51**, 863—872).—A review.

F. J. G.

Minimum property of free energy. R. PEIERLS (Physical Rev., 1938, [ii], **54**, 918—919).—Mathematical.

N. M. B.

Energy of the triatomic hydrogen molecule and ion. V. J. O. HIRSCHFELDER (J. Chem. Physics, 1938, **6**, 795—806).—Mathematical. The energy of H_3 and H_3^+ as a function of the angle between the nuclei has been computed for the ground and excited states. H_3 has its lowest energy for linear configurations. H_3^+ is very stable, left to itself, and has an energy 184 kg.-cal. $<$ that of two H atoms and a proton. The reaction $H_2 + H_2^+ \rightarrow H_3^+ + H$ is exothermic. In the stable configuration of H_3^+ the nuclear separation is $\sim$1·79 A. and lies intermediate between a right-angled and an equilateral triangle. Vibration $\nu\nu$ of H_3^+ have been calc. and two should be active in the infra-red.

W. R. A.

Integrals required for computing the energy of H_3 and of H_3^+. J. O. HIRSCHFELDER and C. M. WEYGANDT (J. Chem. Physics, 1938, **6**, 806—810).—Mathematical. The method of evaluating integrals required in the variational method of calculating the energy of H_3 and H_3^+ is discussed. W. R. A.

F (A., I.)

Migration and photochemical action of excitation energy in crystals. J. FRANCK and E. TELLER (J. Chem. Physics, 1938, **6**, 861—872).—When a crystal absorbs a quantum of light it can be treated either as an assembly of mols. if the exchange of excitation energy between crystal cells is slow compared with the periods of vibration, or as a giant mol. if the exchange is fast. How far excitation energy absorbed by an arbitrary cell of the crystal can be used photochemically at a sp. point possibly far removed from the absorbing cell has been examined theoretically for both cases. The behaviour of polymerised ψ-isocyanines, the hypothetical photosynthetic unit, and the theory of the sensitised photographic plate are discussed from the viewpoint of the theory developed.

W. R. A.

Lattice vibrations in polar crystals. R. H. LYDDANE and K. F. HERZFELD (Physical Rev., 1938, [ii], **54**, 846—861).—Mathematical.

N. M. B.

Quadrupole contributions to London's dispersion forces. H. MARGENAU (J. Chem. Physics, 1938, **6**, 896—899).—A formula has been derived expressing the contributions of terms in R^{-8} and R^{-10} ($R = $ separation between two neutral mols.) to dispersion forces. It involves only measurable quantities, polarisability, absorption frequency, and oscillation strength, and is applicable when the dispersion curve is representable by a single resonant frequency. It has been evaluated for 16 mols. The term in R^{-8} contributes in the region of the van der Waals min. and, except for Na and K, the term in R^{-10} is negligible.

W. R. A.

Comprehensive fundamental electrical formula. C. V. DRYSDALE (Nature, 1938, **142**, 995—996).—A formula which expresses the forces acting on elementary electric charges at rest and in uniform or accelerated motion, without introducing magnetic quantities, is given.

L. S. T.

Absolute measurements of radiometric action in gases. E. FREDLUND (Phil. Mag., 1938, [vii], **26**, 988—1000).—Abs. measurements of the radiometric effect have been determined in H_2, N_2, O_2, A, and air. At low pressure the radiometric force $R \propto p$, the gas pressure, whilst at high pressure $R \propto 1/p^2$. Curves obtained by plotting R as a function of p in a double log diagram can be made to coincide within the entire pressure range (0—10,000 dynes per sq. cm.) by suitable transformations. A reduced radiometric curve is thus obtainable from which the curve for any gas is obtained by a suitable transformation.

W. R. A.

Surface tension–viscosity relation. C. A. BUEHLER (J. Physical Chem., 1938, **42**, 1207—1209).—From the parachor equation and Souders' viscosity relation (A., 1938, I, 131) it is deduced that, at const. temp., $\log_{10} (\log_{10} \eta) = 1\cdot2\gamma^{\frac{1}{4}} - 2\cdot9$.

J. W. S.

Necessity for distinguishing between two definitions of surface tension. L. BRILLOUIN (J. Phys. Radium, 1938, [vii], **9**, 462—464).—From the theoretical viewpoint surface tension, γ, is Ψ/Σ (Ψ is the free energy of a surface layer of area Σ) whereas in discussing experimental methods $\gamma = \delta\Psi/\delta\Sigma$ and

accordingly two vals. of different magnitude are obtained.   W. R. A.

Physico-chemical characteristics of hydronaphthalenes. I. S. DOLDI (Annali Chim. Appl., 1938, **28**, 454—462).—Data for γ, $[P]$, and η (dynamic and static) for tetra-, hexa-, octa-, and (*trans*-)decahydronaphthalene are tabulated and discussed.
                                        F. O. H.

Plural X-ray reflexion methods applied to the problem of the diffraction pattern of calcite. V. L. BOLLMAN, H. H. BAILEY, and J. W. M. DU MOND (Physical Rev., 1938, [ii], **54**, 792—801; cf. A., 1938, I, 15; Miller, *ibid.*, 124).—A detailed account of the extension and attempted practical application of considerations previously reported.
                                        N. M. B.

Quantitative interpretation of abnormal lattice disorder and admixture of amorphous material with active substances. R. FRICKE and E. GWINNER (Z. physikal. Chem., 1938, **183**, 165—176).—The conditions are discussed which must be fulfilled before the mean abs. magnitude of abnormal lattice disorder can be calc. from the state of the integral intensity of Debye–Scherrer photographs with increasing diffraction angle, for all types of lattices containing any no. of different kinds of atoms. The calculation of the mean amplitude of distortion from the photographs is also considered and applied to the study of amorphous impurities on active ZnO (A., 1933, 1119) and active α-Fe_2O_3 (A., 1934, 1083). For non-cubic lattices the mean amplitudes of distortion and of thermal vibration are probably dependent on the crystal directions.   W. R. A.

Resolving power and penetration of X-rays in mosaic crystals. V. DOLEJŠEK and M. JEŽEK (Compt. rend., 1938, **207**, 985—987).—The resolving powers obtainable with SiO_2, NaCl, and ZnS crystals using different focussing arrangements are compared. With large slit–crystal (300 cm.) and crystal–plate distances, mosaic crystals (NaCl) give a resolving power $\gg$ that obtained with perfect crystals (SiO_2).
                                        A. J. E. W.

X-Ray evidence by Cauchois spectrograph on the nature of the surface layers of thin ground quartz crystals. F. R. HIRSH, jun., and J. W. M. DU MOND (Physical Rev., 1938, [ii], **54**, 789—792).—Spuriously doubled lines are observed in spectra formed by the Cauchois transmission-type curved-crystal focussing spectrograph. The more roughly ground of two surfaces on the curved crystal gives rise to the more intense member of the spurious doublet and heavy etching of the ground quartz surface with HF suppresses the surface reflexion. Results indicate that the mechanical stress and consequent strain, incident to bending, existing in the main body of the crystal is not shared by the surface layer which, however, is cryst. and has the grating const. of unstrained quartz; in spite of their disturbance the at. planes in this surface layer must have the same average orientation as the planes in the main body of the supporting crystal. Explanations are discussed.   N. M. B.

Vicinal phenomena and somatoids. K. HUBER (Z. Krist., 1938, **99**, 453—465; cf. A., 1936, 173).—

A review of published work of the author and others with special reference to origin and classification, with illustrations from inorg. salts.   I. McA.

Regions of building up or breaking down processes on the crystal sphere. W. KOSSEL (Ann. Physik, 1938, [v], **33**, 651—660).—A theoretical discussion of etching and growth figures on single-crystal spheres.   O. D. S.

Fourier analysis of interferometric measurements of free molecules. P. DEBYE and M. H. PIRENNE (Ann. Physik, 1938, [v], **33**, 617—629).—The theoretical basis of the method of analysis of Pauling and Brockway (A., 1936, 272) is developed.
                                        O. D. S.

Crystal analysis and point sets. D. M. WRINCH (Nature, 1938, **142**, 955—956; cf. A., 1938, I, 604).—A new method for utilising vector maps to discover at. structure is outlined, and illustrated by reference to insulin.   L. S. T.

Vector maps as positive evidence in crystal analysis. E. H. NEVILLE (Nature, 1938, **142**, 994—995).—A discussion of the use of vector maps in determining crystal structure (cf. preceding abstract).
                                        L. S. T.

X-Ray examination of metals at high temperatures. H. ESSER, W. EILENDER, and K. BUNGARDT (Arch. Eisenhuttenw., 1938—9, **12**, 157—161).—The change in lattice parameter of Pt, Ag, Au, Cu, Al, Ni, and electrolytic Fe with rise in temp. up to 1000° is shown graphically and the true and mean coeff. of expansion are calc. from the results; the vals. obtained differ by up to 8% from these determined dilatometrically but, except for Al and Pt, these differences become smaller with rise in temp. An explanation of this fact is offered. The temp.–parameter curves for Ni and Fe show breaks at the magnetic transformation points, and very pronounced min. in the expansion curves also occur at these points.   A. R. P.

Crystal structure of ammonium cadmium chloride, NH_4CdCl_3. H. BRASSEUR and L. PAULING (J. Amer. Chem. Soc., 1938, **60**, 2886—2890).—X-Ray evidence shows that the unit has a_0 8·96±0·02, b_0 14·87±0·03, c_0 3·97±0·01 A. and contains 4 NH_4CdCl_3 mols. The orthorhombic crystal is based on octahedral co-ordination about the Cd atoms, the $CdCl_6$ octahedra being polymerised into infinite double rutile strings which extend parallel to the c axis. Interat. distances are closely related to those in $CdCl_2$ and NH_4Cl.   E. S. H.

Crystal structure of scandium trifluoride. W. NOWACKI (Naturwiss., 1938, **26**, 801).—ScF_3 crystallises in rhombohedral-pseudocubic crystals with a 5·67, c 7·02 A. (hexagonal axes), and a 4·02 A. α 89° 34′ 30″ (rhombohedral axes) in the space-group D_3^7–$R32$; 1 mol. in the elementary cell. The at. distances Sc—F, Sc—Sc, and F—F are 2·01—2·02, 4·02, and 2·83—2·84 A., respectively.   A. J. M.

Lattice constants and space-group of wagnerite, $Mg(MgF)PO_4$. O. KRAUS and F. MUSSGNUG (Naturwiss., 1938, **26**, 801—802).—Wagnerite has a 11·90, b 12·51, c 9·68 A., β 108° 7′. The most probable

space-group is C_{2h}^5. There are 16 mols. in the elementary cell. A. J. M.

Structure of some triterpenes.—See A., 1939, II, 29.

Diffuse electron diffraction patterns. J. T. BURWELL (J. Chem. Physics, 1938, 6, 749—751).— In the past diffuse electron patterns taken by reflexion methods have been supposed to indicate that polished surfaces are amorphous or very finely cryst. Using a hot-filament type of apparatus, patterns have been obtained for 18 : 8 stainless steel (Cr 18, Ni 8, C 0·08%) (a) polished under C_6H_6, (b) etched electrolytically in 10% $H_2C_2O_4$, (c) vac.-annealed at 1000° and then covered with C_6H_6; (a) showed two diffuse rings, (b) is characteristic of the face-centred cubic structure of the alloy, and (c) was similar to that of the polished sample but grain boundaries were clearly revealed whether C_6H_6 or air was admitted after the vac. annealing. A photomicrograph of the vac.-annealed surface is reproduced. These results show that diffuse patterns can also be obtained from large-grained cryst. materials and therefore such evidence by reflexion methods does not constitute proof of the existence of an amorphous phase. W. R. A.

Electron-diffraction investigation of molecular structures of hydrogen disulphide, dimethyl disulphide, and sulphur dichloride. D. P. STEVENSON and J. Y. BEACH (J. Amer. Chem. Soc., 1938, 60, 2872—2876).—Interat. distances (in A.) and angles recorded are : H_2S_2, S—S 2·05±0·02 ; Me_2S_2, S—S 2·04±0·03, C—S 1·78±0·03, <C–S–S 107±3° ; S_2Cl_2, S—Cl 2·00±0·02, <Cl–S–Cl 103±3°. E. S. H.

Optical properties of evaporated films. D. H. ANDREWS, J. A. SANDERSON, and E. O. HULBURT (Physical Rev., 1937, [ii], 51, 1017).—Reflectivity and transmission in the region 0·185 to 10 μ. have been measured for films of Al, Sb, Be, B, Cr, Mg, Mn, Si, and Te prepared by evaporation in a vac. Min. of reflexion occur in the infra-red for Sb, B, Si, and Te. L. S. T.

Magnetostriction of liquid oxygen. M. WOLFKE (Acta Phys. Polon., 1938, 7, 81—85).—A new apparatus in which O_2 is enclosed in a dilatometer has been used to measure the adiabatic magnetostriction of liquid O_2. The compressibility of O_2 is 1·6 × 10⁻⁴ cm.² per kg. W. R. A.

Theory of the ideal magnetisation curve. F. SAUTER (Ann. Physik, 1938, [v], 33, 672—681).— Mathematical. A wave-mechanical model of a ferromagnetic body is described which, for a body containing N particles, gives results in general agreement with the classical theory, with an error ~$1/N$, except for a small region in the neighbourhood of the Curie point. O. D. S.

Wiedemann–Franz law for metals of any crystal structure in any magnetic field. J. MEIXNER (Ann. Physik, 1938, [v], 33, 682—688).—Mathematical. A proof is given, limited in validity only by the assumptions that temp. is > the Curie temp., and that the degeneration temp. of the electron gas in the metal is sufficiently high. O. D. S.

Magnetic quality of iron wire as influenced by the diameter. T. F. WALL (Nature, 1938, 142, 875—876 ; cf. A., 1938, I, 181).—Curves showing max. and initial slopes each plotted as functions of the diameter of the wire are given for Armco Fe wire heated to a condition of max. permeability. Each curve has a well-defined max., and its general character can be explained by assuming that (i) the wire has a magnetically hard surface layer and (ii) the process of magnetisation commences at the surface of the wire and proceeds progressively towards the axis by a kind of chain effect. L. S. T.

Magnetic Hall effect of pure metals at low temperatures. M. KOHLER (Ann. Physik, 1939, [v], 34, 23—28).—Mathematical. The electron distribution in the presence of external electric and magnetic fields is calc. on the assumption that Planck's distribution functions are obeyed by the lattice waves at low temp. and that an isotropic distribution of eigen-vals. exists. The Hall const. at temp. ≪ Θ (Curie temp.) is calc. to have the same val. as at temp. > Θ. O. D. S.

Effect of radiations on pyroelectric crystals. Possibility of their utilisation as detectors of infra-red radiations. Y. TA (Compt. rend., 1938, 207, 1042—1044).—Light falling on a pyroelectric crystal, e.g., tourmaline, produces a heating effect, θ, of the order of 10⁻⁶ degree. Methods of measuring the pyroelectric currents, from which θ can be calc., are discussed. Various effects have been observed, principally that most of the heating arises from infrared radiation. W. R. A.

Thermal dependence of elasticity in solids. L. BRILLOUIN (Physical Rev., 1938, 54, 916—917).—A theoretical study suggests a distinction between the elasticity coeffs. for very high frequencies (of the elastic waves representing thermal agitation) and for low frequencies. These last coeffs. should show a rapid decrease of rigidity when temp. increases, the m.p. representing zero macroscopic rigidity. N. M. B.

New mesomorphic state : plastic organic crystals. J. TIMMERMANS (J. Chim. phys., 1938, 35, 331—344).—Org. compounds having entropy of fusion <5 × 10⁻⁴ undergo polymorphic changes at temp. below m.p. with large heat absorption ; at temp. between the transition point and m.p., C_p and ε increase, recalling the behaviour in the liquid state, and the crystals are markedly plastic and are able to form mixed crystals with other compounds showing the same phenomena even though of different structure. Such compounds have the common feature of a spherical mol. configuration and provide examples of a new mesomorphic state, that of plastic crystals. F. H.

Magnetic anisotropy of $CuSO_4,5H_2O$ in relation to its crystal structure. III. K. S. KRISHNAN and A. MOOKHERJI (Physical Rev., 1938, [ii], 54, 841—845 ; cf. A., 1938, I, 607).—Magnetic anisotropy was measured in the temp. range 26° to −190°. Observed anisotropy is attributed to that induced in the Cu^{++} ion under the influence of the asymmetric electric field of the neighbouring negatively charged

atoms. From the known positions of these the field should have tetragonal symmetry. The calc. principal susceptibilities of Cu^{++}, along and perpendicular to the tetragonal axis, are tabulated, and corresponding effective magneton nos. computed therefrom vary little with temp., but those corresponding with the two principal susceptibilities of the ion are widely different.   N. M. B.

Paramagnetic absorption in iron ammonium alum in a constant parallel field. F. BRONS and C. J. GORTER (Physica, 1938, 5, 999—1008).—$Fe_2(SO_4)_3(NH_4)_2SO_4,24H_2O$ shows a strong paramagnetic absorption at low temp. (77—90° K.) and at high frequencies ($\sim10^6$) if a strong, parallel magnetic field is applied. The absorption is $\propto$ square of the high-frequency field. The results agree with a formula put forward by Casimir et al. (A., 1938, I, 391) theoretically, but the agreement is fortuitous.
A. J. M.

Spin-lattice equilibrium in cæsium titanium alum at low temperatures. W. J. DE HAAS and F. K. DU PRÉ (Physica, 1938, 5, 969—970).—The paramagnetic relaxation of Cs Ti alum has been investigated. The relative susceptibility of the substance was determined at different low temp. Curie's law was found to be valid from 4·2° to 1·2° K. No decrease of the susceptibility occurred under the influence of an external magnetic field (up to 2000 gauss). The relaxation time for the spin lattice equilibrium is $<10^{-3}$ sec. at 1·2° K. This is $<0·05$ of that found for Fe NH_4 alum under the same conditions.   A. J. M.

Apparent absence of paramagnetic dispersion and absorption in titanium cæsium alum. C. J. GORTER, P. TEUNISSEN, and L. J. DIJKSTRA (Physica, 1938, 5, 1013—1017).—The paramagnetic dispersion and paramagnetic absorption have been determined for $Ti_2(SO_4)_3,Cs_2(SO_4),24H_2O$ at 77·4° K. The dispersion and absorption are both very small. The relaxation const. is $<0·01$ of that for Fe NH_4 alum, contrary to theory, which requires the interaction between spin and crystal lattice to be $<$ for Fe or Cr alum.   A. J. M.

Crystalline diamagnetism of thallium. S. R. RAO and A. S. NARAYANASWAMI (Phil. Mag., 1938, [vii], 26, 1018—1030).—A detailed account of work already noted (cf. A., 1938, I, 127).   W. R. A.

Theory of the change in electric resistance in metals due to hydrostatic pressure. K. HONDA and T. HIRONE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1292—1298).—A previous theory on the nature of free electrons (cf. A., 1932, 676) explains the newly-observed changes at extremely high pressures, but for a few metals a further approximation for the calculation of the mean free path of the electrons is required; it is found that the results satisfactorily explain the new data.   P. G. McC.

Ferromagnetism and electrical properties. IX. Curie point and electrical resistance. H. BITTEL and W. GERLACH (Ann. Physik, 1938, [v], 33, 661—671; cf. A., 1938, I, 504; Kussmann and Schulze, A., 1937, I, 120).—The variation with temp. of the resistance of pure Ni in the neighbourhood of

the Curie point is discussed. The curve shows a turning point, but no discontinuity, at temp. of the magnetically determined Curie point. The effect of inhomogeneity on the electrically and magnetically determined Curie points is discussed. Vals. of the resistance of ideally pure Ni from 100° to 600° are calc. by the Matthiessen rule.   O. D. S.

Superconductivity of liquid helium II and Bose–Einstein statistics. L. TISZA (Compt. rend., 1938, 207, 1035—1037).   W. R. A.

Magnetic properties of superconductors. D. SHOENBERG (Nature, 1938, 142, 874—875).—The magnetisation and the H_c–T curves of the superconducting alloy Au_2Bi are reproduced. Hysteresis is much less marked than for a typical superconducting alloy; the magnetic behaviour approximates to that of an ideal superconductor. Since Au_2Bi is an alloy of definite composition, this behaviour supports the view that the anomalous behaviour of superconducting alloys is due to a secondary cause such as non-homogeneity of composition.   L. S. T.

Relaxation connected with transition from the superconductive to the normal state or vice versa in a constant external magnetic field. P. H. VAN LAER and W. H. KEESOM (Physica, 1938, 5, 986—992).—Experiments with Sn show that the transition from the normal to the superconducting state in a const. external magnetic field is accompanied by a relaxation. The results of experimental work on this relaxation are summarised.   A. J. M.

Reversibility of the transition process between the superconductive and the normal state. P. H. VAN LAER and W. H. KEESOM (Physica, 1938, 5, 993—998).—In the transition of Sn from the normal to the superconducting state there is no irreversible increase in entropy. If by reversibility is understood that the successive states of a system passed through in a process are retraversed on simply reversing the conditions, the transition from the normal to the superconducting state and vice versa at const. temp. may be called reversible. This is valid only for pure metals.   A. J. M.

Velocity of sound in liquid helium. H. J. GROENEWOLD (Nature, 1938, 142, 956—957; cf. A., 1938, I, 391).—The min. at 2·5° K. in the adiabatic compressibility of He I is connected with the rapid rise of c_p/c_v above the λ-point. It disappears in the isothermal curve.   L. S. T.

Velocity and dispersion of audible sound in chlorine. R. SCHULZE (Ann. Physik, 1939, [v], 34, 41—59).—The velocity of sound of frequency from 1000 to 18,000 Hz. in Cl_2 has been measured at 32°, 18°, 0°, and −25°, and 1 atm. pressure, by means of a Thiesen resonator. Calc. vals. of c_v and of the ratio c_p/c_v agree with the Planck–Einstein function with Θ 810. Vals. of c_v calc. from measurements at 440 mm. and 0° and −25° agree with those obtained at 1 atm. Dispersion was observed at the highest frequencies at 0° and −25° and 1 atm. pressure. Calc. vals. of the time of relaxation agree with those of Eucken and Becker (A., 1935, 155).   O. D. S.

Parachor and velocity of sound in metallic elements. B. N. SEN (Gazzetta, 1938, **68**, 662—664).—A relationship is derived from which the velocity of sound in metallic elements can be calc. from the parachor and other at. consts.   O. J. W.

Molecular heat, heat of vaporisation, entropy, and chemical constant of krypton. K. CLUSIUS, A. KRUIS, and F. KONNERTZ (Ann. Physik, 1938, [v], **33**, 642—650).—Vals. for the triple point of Kr are : T, $115.9_5°$ K., p, 549 ± 1.5 mm. The mol. heat has been measured from 63° to 123° K. The heat of vaporisation at the b.p. is 2158 ± 3 g.-cal. per mol. Derived vals. are : entropy at b.p., calc. from sp. heat measurements, 34.64 ± 0.10 Clausius; static entropy at b.p., 34.65 Clausius; v.p. const., $1.29_2 \pm 0.02_2$; chemical const., 1.29_5. Of the conflicting experimental v.p. curves that of Keesom et al. (A., 1935, 1064) agrees best with the calc. curve.   O. D. S.

Heat content and lattice state of active pyrophoric copper. R. FRICKE and F. R. MEYER (Z. physikal. Chem., 1938, **183**, 177—189).—Finely divided pyrophoric Cu, prepared by a variety of methods, has been examined calorimetrically and by X-rays. A certain very active prep. showed abnormal lattice disorder, and had a heat content of 3 kg.-cal. per mol. > that of the normal Cu.   W. R. A.

Heat capacity of potassium sodium tartrate tetrahydrate from 15° to 340° K. J. F. G. HICKS, jun., and J. G. HOOLEY (J. Amer. Chem. Soc., 1938, **60**, 2994—2997).—Heat capacity data are recorded. The heat of transition at 328.78° K. is 10,218 g.-cal. per mol. No discontinuous changes in heat capacity were observed at the Curie points.   E. S. H.

Total heat–entropy diagram for diphenyl. S. J. ELLIS (J. Inst. Civil Eng., 1938—9, 227—240).—From sp. heat data, total heat and entropy data have been deduced for Ph_2 over the temp. range 200—800° F., and are given in graphical form. The possibility of utilising Ph_2 in heat engines is discussed.   J. W. S.

Ebulliometric and tonometric measurements of eight standard liquids. A. ZMACZYNSKI (Congr. int. Quim. pura apl., 1934, **9**, II, 225—236; Chem. Zentr., 1937, i, 1128).—The work of Swientoslawski (A., 1931, 155) is extended to include pressures of 300—2000 mm. EtBr, CS_2, C_6H_6, PhMe, PhCl, and PhBr are suitable but $CHCl_3$ and $COMe_2$ are purified only with difficulty. The ratio dt/dp of substance to dt/dp of H_2O is measured.   A. H. C.

Diffusion properties and activation of zinc sulphide. G. GRAUE and N. RIEHL (Angew. Chem., 1938, **51**, 873—875).—The sp. vol. of cryst. (ignited) ZnS (I) as determined under xylene is 0·242, and with Em in the pyknometer 0·244. The corresponding vals. for freshly pptd. ZnS (II) are 0·264 and 0·204, respectively. (II) contains channels of at. dimensions by which Em can diffuse into the interior of the lattice. (I) evolves Em freely from co-pptd. radio-Th at room temp., but (II) only negligibly. The evolution from (II) becomes appreciable at 300°.

The bearing of the results on the activation of ZnS by diffusion of " phosphorogens " is discussed.   F. J. G.

Vapour pressure of liquids and solids. J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1937, **7**, 867—874).—Mathematical. Expressions have been derived for the v.p. of liquids and solids and give good agreement between observed and calc. vals. for ~ 60 substances.   W. R. A.

Vapour pressure of isotopes. K. F. HERZFELD and E. TELLER (Physical Rev., 1938, [ii], **54**, 912—915).—Mathematical. If all degrees of freedom in a vapour are nearly classical and if there is no association, the v.p. of the lighter isotope is always higher. If only the external degress of freedom are nearly classical and the internal ones are in the lowest state the tendency is for a similar result. Anharmonicity and change in the van der Waals forces probably account for cases in which the heavier isotope has the higher v.p.   N. M. B.

Vapour pressures of molten alkali chlorides and their binary mixtures with sodium chloride. W. KANGRO and H. W. WIEKING (Z. physikal. Chem., 1938, **183**, 199—208).—V.p. of LiCl, NaCl, KCl, RbCl, and CsCl have been measured between 860° and 990°; the vals. for log p are $-7178/T + 7.172$, $-8475/T + 7.906$, $-7450/T + 7.245$, $-7809/T + 7.326$, and $8400/T + 8.302$, respectively. Approx. vals. of the heats of vaporisation have been computed. Binary mixtures of NaCl with each of the other four give partial v.p. throughout the same temp. range in agreement with the Duhem equation but the melts are not " ideal " solutions.   W. R. A.

Vapour pressure measurements on indium halides. C. ROBERT (Helv. Phys. Acta, 1936, **9**, 405—436; Chem. Zentr., 1937, i, 32—33).—The v.p. (p) of InX (X = Cl, Br, I), InX_2, and InX_3 (X = Cl, Br) have been determined over temp. ranges between 225° and 700°. The data have been corr. for traces of InX in InX_2 and SO_2 in $InCl_3$ using absorption spectra obtained simultaneously with the v.p. measurements. Vals. of the b.p., T_c, and of L and C' in the relation $\log p = -L/2.303RT + C'$ are tabulated. Ramsay and Young's rule is applicable. The halides obey the gas laws over certain temp. ranges, in which they exist as single mols. Thermal dissociation is not observed at the max. temp. used. The absorption spectra show that the transition probability of the C band system for InX is > that of the A and B systems, which decreases in the order X = Cl, Br, I (cf. A., 1934, 1286). InX_2 and InX_3 have absorption continua with max. and short-λ limits in the Schumann region, extending to higher $\lambda\lambda$ with increasing p.   A. J. E. W.

Thermal expansion of liquids. R. LUCAS (Compt. rend., 1938, **207**, 900—901).—Theoretical. Relations between thermal expansion and η are discussed with reference to thermal agitation waves in a liquid.   A. J. E. W.

Eigen-value problem of ideal dilute gases. W. LENZ (Ann. Physik, 1938, [v], **33**, 630—641).—Theoretical. Former calculation (cf. A., 1929, 1125)

is extended, by a modification of the Huygens principle, to poly-dimensional systems. For temp. below 1° K., the previously calc. vals. are confirmed.
O. D. S.

Classical equation of state of gaseous helium, neon, and argon. R. A. BUCKINGHAM (Proc. Roy. Soc., 1938, A, 168, 264—283).—The problem of deriving the form of the interaction of rare gas atoms from their observed second virial coeffs. is investigated. The interaction energy is assumed to be of the form $\lambda r^{-s} - \mu r^{-t}$ with $t = 6$ and λ to be a slowly varying function of r. Numerical vals. of the parameters are calc. to give agreement with gas and crystal data.
G. D. P.

Quantum-mechanical theory of the equation of state and the law of corresponding states. Determination of the law of force of helium. J. DE BOER and A. MICHELS (Physica, 1938, 5, 945—957).—Theoretical. The second virial coeff. B can be expressed in the form of a law of corresponding states, starting from a suitable form for the potential of mol. interaction. The quantum-mechanical correction is obtained from the correction term of B given by Uhlenbeck et al., and by Kirkwood. Comparison of these expressions of B with experimental vals. as a function of temp. gives new vals. for the mol. field consts. of He and H.
A. J. M.

Generalisation of thermodynamic potentials deduced from affinity. P. VAN RYSSELBERGHE (Compt. rend., 1938, 207, 845—847).—Theoretical.
A. J. E. W.

Application of thermodynamical principles to thermal conduction. J. E. VERSCHAFFELT (Bull. Acad. roy. Belg., 1938, [v], 24, 593—609).—Theoretical. A theory is developed and compared with that of Defay (A., 1938, I, 574).
A. J. M.

Viscosity of hydrogen and deuterium gas between 293° and 14° K. A. VAN ITTERBEEK and (MISS) A. CLAES (Physica, 1938, 5, 938—944).—A detailed account of work already noted (A., 1939, I, 15).

Viscosity of oxygen in a magnetic field at very low pressures. A. VAN ITTERBEEK and (MISS) A. CLAES (J. Phys. Radium, 1938, [vii], 9, 457—461).—The η of O_2 under the influence of a magnetic field has been measured at ordinary temp. and at 90° K., by the Maxwell oscillation method as a function of the pressure (760 to 0·5 mm.) and of the intensity of the field (max. 869 oersted). At room temp. η diminishes on applying the field, and, at ~15 mm. pressure, passes through a min. which is independent of the dimensions of the apparatus and seems therefore to be characteristic of the O_2. At 90° K. no decrease in η has been observed.
W. R. A.

Viscosity of argon at room temperature and between 90° and 55° K. A. VAN ITTERBEEK and O. VAN PAEMEL (Physica, 1938, 5, 1009—1012).—η of A between 293° and 55° K. has been determined. η is connected with temp. (T) by the expression $\eta = \eta_{90}(T/90)^{0.883}$, where $\eta_{90} = 759\cdot2 \times 10^{-7}$. None of the models proposed by Lennard-Jones for calculating η of A as a function of temp. from the potential

function can be made to agree with experimental results at low temp.
A. J. M.

Electric conductivity and viscosity of molten salts. S. KARPATSCHEV and A. STROMBERG (J. Phys. Chem. Russ., 1938, 11, 852—857).—η of KBr has been measured between 776° and 905°, of KI between 712° and 904°, of NaI 665—914°, LiBr 587—839°, LiI 460—670°, CuCl 520—701°, CaCl$_2$ 806—913°, CdCl$_2$ 582—740°. The sp. gr. of LiI is $2\cdot892 - 0\cdot000570$ for $\theta = 429$—583°. Between η and the conductivity λ the relation exists $\lambda^\nu \eta = $ const., ν being a const. Vals. of both consts. are calc. for 6 salts.
J. J. B.

Viscosity and m.p. in the system hydrazine-water. V. I. SEMISCHIN (J. Gen. Chem. Russ., 1938, 8, 654—661).—The η—composition curves at 0°, 25°, and 50° and the fusion diagram confirm the compound N_2H_4,H_2O, and suggest the equilibrium $N_2H_4,H_2O \rightleftharpoons N_2H_4 + H_2O$. Other compounds are not suggested by the data.
R. T.

Viscosity and density of cadmium chloride solutions at 35°. A. S. CHAKRAVARTI and B. PRASAD (J. Indian Chem. Soc., 1938, 15, 479—482).—d and η of solutions of $CdCl_2$ in H_2O and 0·1N-HCl increase linearly with concn., c, d being increased by $0\cdot9941 + 0\cdot0773c$ and $0\cdot9958 + 0\cdot0807c$ respectively. The Jones and Dole equation ($\eta/\eta_0 = 1 + A\sqrt{c} + Bc$) is applicable to both solutions, indicating that HCl behaves as a mere solvent.
C. R. H.

Relation between the properties of mixed and single solutions. I. Heat capacity of mixed solutions. A. B. ZDANOVSKI. **II. Heat capacity of mixed solutions of the $NaCl-MgCl_2-H_2O$ system at 25°.** A. B. ZDANOVSKI and E. A. MATZENOK (J. Phys. Chem. Russ., 1938, 11, 858—860, 861—863).—I. Heat capacities of mixtures of isotonic solutions are additive; the experiments of Nikolaev et al. (cf. A., I, 1937, 83), which do not agree with this rule, are incorrect.
II. Isotonic solutions of NaCl and MgCl$_2$ conform with the above rule.
J. J. B.

Chemistry [of substances dissolved] in liquid sulphur dioxide. VIII. Sulphur dioxide solvates. G. JANDER and H. MESECH (Z. physikal. Chem., 1938, 183, 121—145).—In a review of recent investigations on SO_2 solvates, the relations between solvate stability and ionic diameter and wt., the influence of lattice energy of SO_2-free salts on solvate formation, and the dependence of solvate stability on the ionic charge are considered. New v.p. data are presented which confirm the existence of $KCNS,2SO_2$; $KCNS,SO_2$; $KCNS,0\cdot5SO_2$; $RbI_3,3SO_2$; $KBr,4SO_2$; $NMe_4Br,2SO_2$; NMe_4Br,SO_2; $NMe_4Cl,2SO_2$; NMe_4Cl,SO_2; $(NMe_4)_2SO_4,6SO_2$; $(NMe_4)_2SO_4,3SO_2$; $p\text{-}C_6H_4O_2,SO_2$. Solvates are not formed by $SbCl_3$, NMe_4ClO_4, and I.
C. R. H.

Chemistry [of substances dissolved] in sulphur dioxides. G. JANDER (Naturwiss., 1938, 26, 779—783, 793—799).—The behaviour of H_2O, liquid NH_3, and liquid SO_2 as ionising solvents is compared. Special reference is made to solutions of thionyl compounds, sulphites, and metabisulphites in liquid

SO_2. The formation of additive compounds with SO_2 is discussed. The behaviour of N compounds and of H_2O in liquid SO_2 is described, and oxidation-reduction reactions in this solvent are considered.
　　　　　　　　　　　　　　　　　A. J. M.

Dielectric absorption and dielectric constant of solutions of aliphatic amino-acids. H. FRICKE and A. PARTS (J. Physical Chem., 1938, 42, 1171—1185).—The dielectric absorptions (a) and dielectric const. (ϵ) of aq. solutions of glycine, alanine, α- and γ-aminobutyric acid, and α- and ϵ-aminohexoic acid of various concns. (c) have been measured at $\nu \not> 65.6 \times 10^6$ cycles per sec. In each case ϵ is approx. $\propto c$, and a, represented by the equiv. electrical conductance, $\propto \nu^2$. With varying c, $a \propto \eta$. The results indicate that the ratio of polarising electric force to average electric force in the solutions is approx. independent of the degree of polarisation. The vols. of the NH_2-acid mols., deduced from the results, are $<$ the true vols., but are nearer to the latter than the vals. derived from the electrical mobilities by application of Stokes' law.　　　　　J. W. S.

Magnetic susceptibility and electrical sign of solutions of hæmatin and acetylhæmin. (MLLE.) P. BERTHIER (Compt. rend., 1938, 207, 1254—1256).—Vals. of χ in 0.1N-NaOH are : hæmatin (I), 1.17; acetylhæmin (II), 1.83; hæmoglobin, 0.56×10^{-6}. Measurements of the capillary ascent in filter-paper indicate that (I) and (II) are electronegative in 0.1N-NaOH, the negative character becoming less pronounced on addition of acid.　　　A. J. E. W.

Influence of the p_H of the solution on the fluorescence spectrum of a solute. M. KON-STANTINOVA-SCHLESINGER (J. Phys. Chem. Russ., 1938, 11, 601—605).—The fluorescence of acridine is green in acid and violet in alkaline solution, and that of quinine salts is blue in acid and violet in alkali. The fluorescence spectra of these solutions were determined, and can be interpreted in terms of the different fluorescence of different ions or mols. The relation between p_H and the fluorescence of fluorescein is more complicated. A determination of p_H is necessary when using fluorescence in analysis.
　　　　　　　　　　　　　　　　　J. J. B.

Supersaturated solutions, particularly of calcium salts. L. HAMBURGER (Chem. Weekblad, 1938, 35, 886—906).—The mechanism of crystallisation, particularly of Ca salts of org. acids, is discussed fully both mathematically and practically, especially as regards the ultimate size of the nuclei about which crystal growth starts and the significance of the induction period and the mode of growth.　　S. C.

Solubility of hydrogen in aluminium and some aluminium alloys. W. BAUKLOH and F. OESTER-LEN (Z. Metallk., 1938, 30, 386—389).—H_2 is insol. in solid Al but the solubility in the molten metal increases rapidly with rise in temp., reaching nearly 3 c.c. per 100 g. at 900°. Addition of Cu, Si, Mn, and Ni reduces the solubility of H_2 in molten Al, but Mn and Ni render the gas sol. in solid Al. Addition of Mg considerably increases the solubility.
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Precipitation-hardening of alloys.—See B., 1939, 54.

Silver–zinc equilibrium diagram and the structure of the ζ-phase. E. A. OWEN and I. G. EDMUNDS (J. Inst. Metals, 1938, 63, Advance copy, 297—307).—The Ag–Zn diagram based on X-ray studies previously published by the authors is given in detail. The ζ-phase has a close-packed hexagonal structure with 54 atoms per unit cell, c/a 0.742, a 7.615 A. The composition at the peritectic temp. at which a phase becomes saturated is in all cases such that the at. ratio of Ag : Zn can be expressed by simple whole nos.　　　A. R. P.

X-Ray study of silver–zinc alloys rich in silver, below the β-transformation temperature. E. A. OWEN and I. G. EDMUNDS (J. Inst. Metals, 1938, 63, Advance copy, 285—296).—The $\alpha + \beta \to \alpha + \zeta$ transformation occurs at 270° in alloys with 71.2—65.9% Ag, the $\beta \to \zeta$ transformation over a narrow temp. range between 270° (66% Ag) and 289° (61% Ag), and the $\beta + \gamma \to \zeta + \gamma$ at 289° with 61.4—51.4% Ag; below the transformation temp. the boundaries between the α, $\alpha + \zeta$, ζ, and $\zeta + \gamma$ fields slope slightly towards the Ag side, whilst the $\zeta + \gamma \to \gamma$ boundary slopes towards the Zn side so that the γ-field commences at 52.8% Ag at 500° and 50.3% at 200°.　　　　　　　A. R. P.

Rates of diffusion of copper and zinc in α-brass. E. KIRKENDALL, L. THOMASSEN, and C. UPTHEGROVE (Amer. Inst. Min. Met. Eng., Tech. Publ. 967, 1938, 18 pp.; Met. Tech., 1938, 5, No. 7).—The rates of diffusion of Cu and Zn in α-brass containing 25.3, 26.8, and 28.3% of Zn were determined at 720°, 655°, and 600° respectively. The data obtained substantiate the Dushman–Langmuir equation.
　　　　　　　　　　　　　　　　　R. B. C.

Alloys of indium with gold. O. KUBASCHEWSKI and F. WEIBKE (Z. Elektrochem., 1938, 44, 870—877).—The equilibrium diagram has been determined by thermal analysis and microscopical and X-ray examination. The solid solubility limit of In in Au is 8.5% at 647° and 4.0% at 410°. The regions of stability of Au_7In_3, $AuIn$, and $AuIn_2$ have been determined.　　　　　E. S. H.

Diffusion of magnesium in aluminium. W. BUNGARDT and F. BOLLENRATH (Z. Metallk., 1938, 30, 377—383).—The coeff. of diffusion of Mg in Al at 420° is 6.6×10^{-5} sq. cm. per day and at 520° 4.5×10^{-4} sq. cm. per day; addition of 2.7% Zn to the Al reduces these vals. to 3.6×10^{-5} and 1.9×10^{-4} sq. cm. per day respectively. With increasing temp. the diffusion const. of Mg in Al depends to a considerable extent on [Mg] when the Mg content is high.
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Constitution of aluminium–zinc alloys of high purity : nature of the thermal change at 443°. M. L. V. GAYLER and E. G. SUTHERLAND (J. Inst. Metals, 1938, 63, Advance copy, 387—401).—Thermal analysis of Al–Zn alloys with 40—100% Zn shows that, with const. stirring, the heat change which occurs on heating takes place over a temp. range and not at const. temp. The temp. at which max. heat absorption occurs falls with increasing Zn content, and, on cooling, a heat evolution occurs at nearly const. temp. Microscopical examination shows no evidence of the existence of a two-phase field above

360° or of a reaction compound, nor of any primary separation, other than that of the Al solid solution, between the m.p. of Al and that of the eutectic. The heat change which occurs between 440° and 470° is due to a change of 12% Zn in the composition of the primary Al phase which takes place during solidification over about 12°. The eutectic temp. is 382° and the solidus shows a peculiar " flattening out " between 62 and 70% Zn which is ascribed to the reaction liquid + α → AlZn. A complete equilibrium diagram is given together with microstructures of alloys with 68—94% Zn.   A. R. P.

Rate of crystallisation and crystallite number of lead with small additions of calcium, strontium, barium, and silver. E. JENCKEL [with H. POETSCH] (Z. Metallk., 1938, 30, 396—399).—By melting Pb in vac. the no. of crystallites formed on solidification is more reproducible and < when the metal is melted in air. Addition of small quantities of Ca, Sr, Ba, or Ag to produce a second phase considerably increases the no. of crystallites, i.e., causes grain refinement; only 0·7 at.-% Ca is necessary to produce a very fine-grained alloy. The rate of crystallisation of alloys of Pb with the above metals depends on the concn. of the metal and the degree of undercooling it produces; in some cases small additions accelerate it and in other cases retard this rate.   A. R. P.

Solubility of lead and bismuth in liquid aluminium and aluminium–copper alloys. L. W. KEMPF and K. R. VAN HORN (Amer. Inst. Min. Met. Eng., Tech. Publ. 990, 1938, 12 pp.; Met. Tech., 1938, 5, No. 8).—The solubility of Pb in liquid Al is 1·52% at the f.p. (660°), increasing to 14·75% at 1038°. That of Bi is 3·36% at 660° and 15·19% at 877°. The f.p. of Al is lowered by Pb to a min. of 658·5° and by Bi to 657·1°. The solubilities of Pb and Bi in solid Al are ≯0·2 wt.-% at the m.p. of Al, and decrease with temp. The solubilities of Pb and Bi in liquid Al are slightly decreased by presence in alloys of ~5% of Cu.   R. B. C.

Electronic structure of the 3d layers of atoms of nickel and of copper in nickel–copper alloys. J. FARINEAU and M. MORAND (J. Phys. Radium, 1938, [vii], 9, 447—450).—By studying the distribution of intensity of the Lα rays of Ni and Cu emitted by Ni–Cu alloys of varied composition, the distribution of electrons in the 3d layers of these metals has been determined. The size of the 3d bands of each metal diminishes as the metal concn. in the alloy decreases.   W. R. A.

Activation and the composition of the elementary moment in ferromagnetic alloys. R. FORRER (Compt. rend., 1938, 207, 1091—1093).—From curves obtained by plotting the at. moments of Fe–Co, Ni–Co, and Fe–Ni alloys, expressed in Weiss magnetons, as a function of at. no., a new conception of the at. moment is developed; it consists of two parts : (i) the basic moment due to the spin of electrons and measured by 1 Bohr magneton per single electron, and (ii) a supplementary moment varying between a high and a low limit, with a max. val. of 1 Weiss magneton for a spin moment of 1

Bohr magneton. The nature of (ii) and the significance of the Weiss magneton are discussed.   W. R. A.

System iron–niobium. R. VOGEL and R. ERGANG (Arch. Eisenhüttenw., 1938—9, 12, 155—156). —There is one compound only, Fe_5Nb_3, m.p. ~1650°, in this system; it forms simple eutectiferous series both with Fe and Nb, the eutectic points being 1360°, 21% Nb, and 1515°, 73% Nb, respectively. Fe dissolves ~5% Nb at 1360° and ~3% Nb at 1100° and lower. Fe_5Nb_3 dissolves ~1% Fe and ~1% Nb, the solubility of both metals rising only slightly with rise in temp.   A. R. P.

Ternary alloys containing magnesium and cadmium and the equilibrium diagram of binary magnesium–cadmium alloys. I. E. JÄNECKE [with L. NEUNDEUBEL and K. RUMPF] (Z. Metallk., 1938, 30, 390—395).—The equilibria determined by thermal analysis are shown in a ternary diagram; the ternary eutectic is at 194°, Cd 19·5, Pb 56, Mg 24·5 at.-%. Along the Mg–Cd side there are 5 narrow regions of solid solutions, α, β, γ, δ, and ε, with invariant points at 435°, Pb 10, Mg 71, Cd 19 at.-%; 386°, Pb 6, Mg 51, Cd 43 at.-%; 321°, Pb 5, Mg 28, Cd 67 at.-%; and 287° Pb 8, Mg 15, Cd 77 at.-%.   A. R. P.

Ternary aluminium systems. I. Aluminium–iron–magnesium, aluminium–magnesium–manganese, aluminium–manganese–silicon. H. HANEMANN and A. SCHRADER (Z. Metallk., 1938, 30, 383—386).—In the Al–Fe–Mg system the Al corner contains the phases α-Al, $FeAl_3$, and Mg_2Al_3 which form a eutectic at 445°, Al 68, Fe 3, Mg 29%. In the Al corner of the Al–Mg–Mn system crystallisation of alloys with a low Mg content corresponds with a stable system, the primary crystals consisting of α-Al, $MnAl_6$, $MnAl_4$, $MnAl_3$, and Mg_2Al_3, and crystallisation of those with a high Mg content with a metastable system involving the phases α-Al, $MnAl_4$, $MnAl_3$, and Mg_2Al_3; there is a ternary eutectic at 437°, Al 71·25, Mg 26·4, Mn 2·35% which consists of α, $MnAl_6$, and Mg_2Al_3 in the stable, and α, $MnAl_4$, and Mg_2Al_3 in the metastable, system. The Al–Mn–Si system has a ternary eutectic at 575·5°, Al 86·8, Si 12, Mn 1·2% consisting of α-Al, Si, and a ternary phase with Al 45, Mn 40, Si 15%; there are three peritectic transformations : at 647° in mixtures containing Mn 2·6 and 1·7% Si, at 690° with Mn 3—3·3 and Si 1·5%, and at 710° with Mn 3·8 and Al 1·2%.   A. R. P.

Iron corner of the iron–silicon–titanium system. R. VOGEL and W. SCHLÜTER (Arch. Eisenhüttenw., 1938—9, 12, 207—212).—The system contains two ternary compounds, FeSiTi (I) and Fe_7Si_5Ti (II); (I) melts at 1650° and forms a eutectic at 1500° with Fe_2Ti, whilst (II) forms a series of solid solutions with Fe_3Si_2. There are ternary eutectic points at 1205° and 1145°. The complete diagram Fe–FeSi–FeSiTi–Fe_2Ti, 8 sectional diagrams, and 16 characteristic microstructures are shown.   A. R. P.

System iron–iron tungstide–iron titanide. R. VOGEL and R. ERGANG (Arch. Eisenhüttenw., 1938—9, 12, 149—153).—Fe_3W_2 and Fe_2Ti form a continuous

series of solid solutions. In the section Fe–Fe_3W_2–Fe_2Ti the primary crystallites consist of ternary α-Fe, the solid solution of the two compounds, or 98—99% W crystals, according to the composition. Addition of W to Fe–Ti alloys broadens considerably the α-range, especially above 1000°. The ternary diagram, 11 sectional diagrams, and 6 characteristic micro-structures are reproduced. A. R. P.

Solubility of nitrogen and argon in sea-water. N. W. RAKESTRAW and V. M. EMMEL (J. Physical Chem., 1938, **42**, 1211—1215).—Data are recorded for the solubilities of N_2 and of the total atm. inert gas in sea-H_2O containing 1·6—2% of Cl' at 0—30°. J. W. S.

Connexion between conductivity of binary liquid systems and their solubility in a third component. R. V. MERTZLIN and E. F. SHURAVLEV (J. Gen. Chem. Russ., 1938, **8**, 635—641).—Theoretical. A relation is supposed to exist between the conductivity of binary liquid systems and their solubility in a third component. R. T.

Solubility of siliceous dusts and the inhibitory action of added dusts. A. G. R. WHITEHOUSE (J. Ind. Hyg., 1938, **20**, 556—565).—Suspensions of 1 g. of dust (particle size 0—6 μ.) in 100 c.c. of 1% Na_2CO_3 were kept at 37° and the rate of dissolution was measured. Flint was the most sol. and shale dust least sol. The addition of shale and coal dusts to a quartz suspension reduced the rate of dissolution by 1—78%. Gypsum, which reduced the p_H of the suspension from 12 to 8·5, was the most active; and the effectiveness of shale dust increased slightly with its fineness. Al_2O_3 and fine shale dust reduced the SiO_2 content of silicate solutions under identical conditions by 94 and 21% respectively. E. M. K.

Solubility of barium oxalate in aqueous salt solutions. R. W. MONEY and C. W. DAVIES (J.C.S., 1938, 2098—2100).—The solubility of $BaC_2O_4,2H_2O$ has been determined at 25° in aq. KCl and KNO_3 of concn. ≯0·1M. and in aq. $MnSO_4$ of concn. ≯0·005M., and the mean ionic activity coeffs. ($f_\pm$) of BaC_2O_4 are deduced. The latter are in accord with the empirical equation $-\log f_\pm = 2\sqrt{I}/(1 + \sqrt{I}) - 0·40I$ (cf. A., 1939, I, 79). The increase in solubility produced by MnC_2O_4 is about 10 times as great as with aq. KCl of the same ionic strength, and is in accord with the dissociation const. of MnC_2O_4 deduced from conductivity measurements (A., 1932, 912). J. W. S.

Solvent properties of aqueous solutions of paraffin-chain salts. I. Solubility of *trans*-azobenzene in solution of cetylpyridinium salts. G. S. HARTLEY (J.C.S., 1938, 1969—1975).—The solubility of *trans*-azobenzene (I) in 0—0·5N. solutions of several cetylpyridinium salts has been determined. Over wide concn. ranges the ratio of (I) to cetylpyridinium ions (II) is approx. const. and of the same order as the mol. ratio in saturated solutions of (I) in paraffins in bulk. The ratio varies somewhat with the nature of the anion, indicating a modification of the solubility by the ionic environment. The solubility of (I) increases rapidly in the concn. range over which transition occurs from the disperse to the micellar state of (II). The concn. at which this

increase occurs is lowered by the addition of NaCl or Na_2SO_4, in accord with theory. The *compound* $NPh:NPh,C_6H_6$ is reported. J. W. S.

Electrochemistry of the corrosion of partly immersed zinc. R. S. THORNHILL and U. R. EVANS (J.C.S., 1938, 2109—2114).—A " dielectrode " designed for the determination of cathodic and anodic areas on partly immersed metal is described. When Zn is freshly washed in N-H_2SO_4 and partly immersed in 0·001N-NaCl it is attacked mainly along the meniscus foot, the region between this and the meniscus head remaining free from corrosion for at least two weeks provided that evaporation and disturbance are avoided. Electrical measurements indicate that all regions where corrosion is observed are anodic, suggesting that corrosion is entirely electrochemical, and that the cathode reaction occurs almost exclusively at the meniscus head, where O is most readily supplied. Places on the lower part of the specimen which escape serious attack are neutral, not cathodic. J. W. S.

Corrosion of metals by salt solutions and natural waters.—See B., 1939, 55.

Liquid sulphur dioxide as a solvent for inorganic substances. A. I. SCHATTENSTEIN and M. M. VIKTOROV (Acta Physicochim. U.R.S.S., 1937, **7**, 883—898).—The solubility of 87 inorg. substances in liquid SO_2 has been qualitatively determined, and quant. data at 25° are recorded for the solubility of 13 halides of Na, K, Li, NH_4, Ca, Sr, Cs, and Rb. W. R. A.

Solubility in the solid state : mixed crystals. J. A. A. KETELAAR (Chem. Weekblad, 1938, **35**, 852—859).—A review. S. C.

Diffusion of hydrogen through iron at temperatures between 780° and 90°. W. L. RAST and W. R. HAM (Physical Rev., 1937, [ii], **51**, 1015—1016).—Abrupt changes in the slope of the log (rate of diffusion)-T^{-1} curve occur at 767°, 729°, and 200°. Near 200° the rate decreases markedly, and the decrease in the rate with a fall in temp. to 90° becomes very small. L. S. T.

Possibilities of diffusion of gases in metals and between two solid phases. W. BAUKLOH and B. KNAPP (Metallwirts., 1938, **17**, 1302—1304).—A crit. review of published work. Three kinds of diffusion, through the grain boundaries, lattice, or surface, are recognised. E. S. H.

Distribution of radium-*D* between crystals and solutions of $Ba(IO_3)_2$. A. POLESSITSKI (Acta Physicochim. U.R.S.S., 1938, **8**, 864—868).—Measurements of the distribution in the presence and absence of $Ca(NO_3)_2$ in the solutions are in agreement with Ratner's thermodynamical theory, as found previously for Ra (A., 1938, I, 614). F. L. U.

Absorption of sulphur dioxide in water.—See B., 1939, 39.

Mechanism of adsorption. I. New theory of adsorption. B. GOUGUELL and E. RUDERMAN (Acta Physicochim. U.R.S.S., 1938, **8**, 795—810).—The theory proposed is an amplification of Ward's

(cf. A., 1931, 1365), in which slow adsorption is assumed to be due to surface migration of gas mols. into cracks difficult of access and impermeable to vol. flow. It is shown that the total vol. of these cracks must be considerable, and experiments have been devised which reveal an apparent desorption following an increase of pressure. The existence of this effect, which is predicted, provides experimental support for the surface crack theory. The rate-determining process in adsorption is surface migration into the cracks. The energy requirements of the process are satisfied by postulating the formation of multimol. layers. The diminution of the abs. adsorption sometimes observed at low temp. is explained by the effective blocking of the cracks owing to the greatly diminished rate of diffusion, thus reducing the available area. The new theory provides an escape from the improbabilities inherent in the theory of "activated adsorption."   F. L. U.

Conditions of phase equilibrium in systems containing halides and free halogens. II. Distribution of bromine between aqueous potassium bromide and benzene. A. I. LICHATSCHEVA and G. P. LUTSCHINSKI (J. Gen. Chem. Russ., 1938, 8, 916—923).—The solubility of Br in aq. KBr is $\propto$ [KBr]. In the system C_6H_6–Br–H_2O the [Br] of the C_6H_6 layer varies parallel with that of the aq. layer, but the partition coeff. falls as the [Br] of the latter rises. The [Br] of the C_6H_6 layer in the system C_6H_6–Br–KBr–H_2O varies inversely as the concn. of aq. KBr. The d–composition curves of the system KBr–Br–H_2O at 20° are given.   R. T.

Adsorption of gases from very low to very high pressures. H. ZEISE (Z. Elektrochem., 1938, 44, 912—913). A. VON ANTROPOFF (ibid., 913—914).—Polemical (cf. A., 1936, 1063; 1938, I, 569).   E. S. H.

Heats of adsorption of gases by chromic oxide at low temperatures. R. A. BEEBE and D. A. DOWDEN (J. Amer. Chem. Soc., 1938, 60, 2912—2922).—The vals. obtained for the adsorption of A, H_2, D_2, CO, N_2, and O_2 indicate that the gases (excepting A) are adsorbed in part in the activated state even at $-183°$. Time–temp. curves for a partly covered surface at $-183°$ indicate that CO, N_2, and O_2 are adsorbed initially in the van der Waals state and undergo a slow change into a state of activated adsorption. The activation energy of this slow surface change, estimated from heat measurements with CO at $-183°$ and $-195°$, is 180—690 g.-cal. per mol. The rate-controlling process may be a slow activated adsorption or surface diffusion. The mutual influence of CO and O_2 on their heats of adsorption has been investigated.   E. S. H.

Thermodynamic equation of the adsorption isotherm of two ions. E. N. GAPON (J. Phys. Chem. Russ., 1938, 11, 782—792).—Simultaneous adsorption of two ions is treated thermodynamically.   J. J. B.

Sorptive properties and character of porosity of active charcoal obtained from sugar by the method of inorganic additions. E. D. ZAVERINA (J. Phys. Chem. Russ., 1938, 11, 629—637).—Sugar was heated with salts in CO_2 at 600° or 850° for 1 hr. The adsorptive capacity of the C obtained for I, PhOH, methylene-blue, and for C_6H_6 at high v.p., increases with the ratio $ZnCl_2 : C_{12}H_{22}O_{11}$, and that for C_6H_6 at low gas pressures is a max. when the mol. ratio $ZnCl_2 :$ sugar $= 1$. Presumably the excess of $ZnCl_2$ over 1 mol. causes an extension of the pores involving a decrease of the active surface of the C. 1 mol. of $ZnCl_2$ + 5 mols. of NaCl or KCl activate C less, and $1ZnCl_2 + 5NH_4Cl$ slightly more, than $1ZnCl_2$ alone. $ZnBr_2$ and ZnI_2 are as effective as $ZnCl_2$, $Zn(NO_3)_2$ less, and $ZnSO_4$ least. Much less active are other salts, e.g., $K_2CO_3 > CuSO_4 > KI$. The yield of C is >100 g. per mol. of sugar when $ZnCl_2$, ZnI_2, NH_4Cl, or NH_4SCN is used; it is very small with $Zn(NO_3)_2$ or K_2CO_3.   J. J. B.

Binary systems. II. Heats of adsorption from mixtures of toluene and acetic acid by charcoal and silica gel. III. Adsorption and heats of adsorption from mixtures of methyl alcohol and water by activated charcoal and silica gel. IV. Adsorption from mixtures of toluene and acetic acid by de-ashed animal charcoal. J. G. KANE and S. K. K. JATKAR (J. Indian Inst. Sci, 1938, 21, A, 385—394, 407—411, 413—416; cf. A., 1939, I, 21).—II. Heats of adsorption of PhMe–AcOH mixtures by SiO_2 gel, animal and sugar charcoals have been determined. The curve relating deviation of observed heat of adsorption from that calc. from the heats of wetting of the components and composition of the mixture is similar to the adsorption isotherm for SiO_2 and animal C, but not for sugar C, where PhMe has a higher heat of wetting and is preferentially adsorbed. The compositions of mixtures giving max., zero, and min. deviations for animal and sugar C correspond with complexes of PhMe with 1 to 4 $(AcOH)_2$.

III. Similar tests have been made with MeOH–H_2O mixtures adsorbed on SiO_2 gel and on Norite. The adsorption isotherm and the curve relating heat of adsorption with composition for Norite confirm the existence of $MeOH,2H_2O$. Vals. of sp. gr. of MeOH solutions at 30° are tabulated.

IV. Animal C de-ashed with HF and activated gives an adsorption isotherm with PhMe–AcOH mixtures the reverse of that obtained with sugar C, indicating that the former preferentially adsorbs AcOH and the latter PhMe.   F. H.

Adsorption of methylene-blue by active carbon. M. V. C. SASTRI (Current Sci., 1938, 7, 228).—The adsorption of methylene-blue on active C is accompanied by a fall of p_H owing to liberation of HCl. The adsorption is a min. at an equilibrium p_H of 3·75, and then rises rapidly in the p_H range 3·75—3·97.   F. J. G.

Adsorption of organic acids by silica gel. E. N. GAPON (J. Phys. Chem. Russ., 1938, 11, 651—653).—Empirical equations are put forward for Bartell and Fu's measurements (cf. A., 1929, 757).   J. J. B.

Inner adsorption in salt crystal systems. VI. D. BALAREV (Z. anal. Chem., 1938, 115, 104—117; cf. A., 1937, I, 25).—Adsorption at the external surface of single crystals or macro-particles etc.

(external adsorption) should be differentiated from that at the inner surfaces of a solid system or aggregate of particles. "Sorption" should be used only for absorption in the lattice or migration between the ions of the lattice or an amorphous mass. The pptn. of $BaSO_4$ from dil. H_2SO_4 under conditions most favourable to obtaining a pure ppt. is discussed in relation to the theory of inner adsorption. The Winkler process for gravimetric analysis is criticised. The Njegovan method of pptn. from conc. solutions (A., 1928, 497) possesses all the disadvantages of a process involving a compensation of errors.

L. S. T.

Adsorption with a specimen of barium sulphate provided by Mlle. de Brouckère. I. M. KOLTHOFF and A. H. BUSHEY (Bull. Soc. chim. Belg., 1938, **47**, 689—701).—Experiments on dehydration by heat and adsorption of KCl, and measurements of sp. surface, gave results in general agreement with those obtained with material prepared by the authors (A., 1936, 1064), and entirely at variance with those of de Brouckère (ibid., 423).

F. L. U.

Adsorbent properties of barium sulphate. II. L. DE BROUCKÈRE (Bull. Soc. chim. Belg., 1938, **47**, 702—716).—Specimens of $BaSO_4$ prepared by Kolthoff, examined microscopically, present a cryst. form different from that of the author's preps., and have a much smaller sp. surface. Further experiments indicate that the preliminary treatment given by Kolthoff and Bushey (cf. preceding abstract) greatly reduced the absorbent properties of both their own material and that provided by the author.

F. L. U.

Influence of the fine structure of adsorption layers on the adherence of microscopic particles. A. VON BUZÁGH (Kolloid-Z., 1938, **85**, 318—324).—Published work is summarised.

E. S. H.

Sorption of surface films of aliphatic compounds of high mol. wt. by a solid disperse phase. I. Use of two-dimensional manometry for sorption analysis. Kinetics of sorption. II. Sorption isotherms. Desorption. A. ACHMATOV (J. Phys. Chem. Russ., 1938, **11**, 745—757, 758—771).—I. If the floating barrier separating the contaminated from the pure H_2O surface is rigidly connected with a dynamometer coil, the two-dimensional pressure p is measured by the current required to prevent turning of the coil. This method is better than those generally used. The p of oleic acid monolayers on 0·01N-HCl decreases when C powder is put on the surface. The decrease is $\propto$ the mass of C and is the larger the finer is the powder; it is nearly complete within 30—60 min. Myristic instead of oleic acid, and surface potentials instead of surface pressure, can be used.

II. The decrease of p at various p vals. gives the sorption isotherm. An extrapolation of the curve gives for the max. sorption 10^{-5} mol. of oleic, or $2·5 \times 10^{-5}$ mol. of myristic acid per 1 g. of C. C takes up 5000 times as much substance as does S or talc. A part of the substance sorbed returns to the surface when p is reduced. HCl from the solution is sorbed along with the monolayer. Sorption

of surface films by C may be used for cleaning surfaces. Myristic acid monolayers are sol. in H_2O and (less so) in dil. HCl; the amount dissolved in 3—4 hr. increases linearly with p.

J. J. B.

Thermal properties and heats of adsorption of films on vitreous silica. W. G. PALMER (Proc. Roy. Soc., 1938, **A**, **168**, 190—206).—Adsorption isotherms of C_6H_6, $COMe_2$, and MeOH are measured from 25° to 70°. Vals. of thermal expansion, compressibility, and variation of lateral force are calc. and are compared with similar properties of the bulk phases. Heats of adsorption are calc. from the temp. variation of adsorption potential.

G. D. P.

Kinetics of the formation and solvation of two-dimensional colloids. P. F. POCHIL, T. J. SILBERMAN, and D. L. TALMUD (Acta Physicochim. U.R.S.S., 1937, **7**, 849—866).—Methods by which two-dimensional colloids can be obtained by condensation in the process of double decomp. are described. These have been employed in the formation of colloids of silicic acid, $Fe(OH)_3$, $Al(OH)_3$, Ba and Ag myristate, and combinations of cetyl alcohol with Ag and Ba. The kinetics of formation of these colloids, measured by static and dynamic methods involving the decrease in the surface pressure of monolayers due to aggregation of mols. in the latter, indicate (a) the total no. of aggregating mols. in the monolayer, (b) the order of magnitude of the particles of the colloid. Individual aggregates consist of ~1000 mols. The connexion is discussed between the formation and properties of a two-dimensional colloid with the solvation of the polar groups in the monolayer, and with the adsorption of the excess ions of a given charge.

W. R. A.

Molecular interaction in mixed monolayers on aqueous subsolutions. I. Mixtures of alcohols, acids, and amines. W. D. HARKINS and R. T. FLORENCE. **II. Unstable mixtures with unsaturated acids.** R. T. FLORENCE and W. D. HARKINS (J. Chem. Physics, 1938, **6**, 847—856, 857—860).—Mixed films of long-chain alcohols, acids, and amines on aq. solutions of p_H 3 and p_H 9·5 have been examined. In general a mixture of two liquid films gives a monolayer of the same type with the mean mol. area. A liquid expanded film is condensed by adding a substance which gives a condensed film; this condensing action increases with the hydrocarbon chain length and an acid film is condensed more by added alcohol than by the corresponding acid. Only in amine–acid mixtures is there evidence of chemical reaction. A 1 : 1 mixture of stearyl alcohol and stearic acid "freezes" at a much larger area than the film given by either. $Ca^{··}$ in the solution of p_H 9·5 tend to cause formation of solid films.

II. Oleic acid, in admixture with a saturated long-chain acid, alcohol, or amine, can be squeezed completely out of the mixed film by compression, indicating that oleic acid is bound more weakly to the other mols. than they are to each other. Since the presence of a double linking has previously been shown to confer greater energy of binding between mols., it is concluded that the shape of oleic acid is responsible for the decrease in the energy of binding. It has a *cis*

structure, one 9-C chain being bent back with respect to the other 9-C chain. On the other hand, elaidic acid has a *trans* structure and its energy of binding should be intermediate between those of oleic and stearic acids and, accordingly, it should not be, and in fact is not, squeezed out of mixed layers completely by compresssion. W. R. A.

Pressure–area relations for unimolecular films of tri-*p*-tolyl phosphate and related compounds. H. E. RIES, jun. (J. Amer. Chem. Soc., 1938, **60**, 3087—3088).—$(p\text{-}C_6H_4Me)_3PO_4$ forms readily compressible films on H_2O, whilst $(p\text{-}C_6H_4Me)_3PO_3$ and $(p\text{-}C_6H_4Me)_3PO_3S$ have poor film-forming properties. An important contribution to the polarity of the mol. appears to be made by the P:O group. E. S. H.

Electrical properties of stearate films deposited on metal. E. F. PORTER and J. WYMAN, jun. (J. Amer. Chem. Soc., 1938, **60**, 2855—2869).—Voltage measurements of circuits involving X and Y films show that the potentials of the films are neutralised by contact with polar liquids (but not C_6H_6), although they reappear after the films are separated from the liquids. Contact potentials induced in X and Y films are not abolished by dipping in Hg, but those in Y films are abolished by contact with H_2O or $CHCl_3$. When a p.d. is applied between slide and liquid during building of a film, the potential–layer curves are displaced without alteration of shape after the first three layers. X or Y films containing Pb fail to develop large contact potentials under all conditions. Impedance measurements at frequencies of 1 and 0·244 megacycles show no significant difference between X and Y films. The dielectric const. is about 2·5. X and Y films have the same breakdown voltages, which increase with the thickness of films in contact with Hg, and correspond with fields of the order of 10^6 v. per cm. Apparent breakdown voltages of films in contact with H_2O are nearly independent of thickness. The sp. d.c. resistance of X and Y films is about 10^{13} ohms. E. S. H.

Dipole moment and surface potentials. M. GEROVICH, A. FRUMKIN, and D. VARGIN (J. Chem. Physics, 1938, **6**, 906).—Surface potential (V_0)-area curves are given for mixtures of ω-bromohexadecoic acid (I) and palmitic acid (II) on 0·01N-HCl. Mixed films containing <50% of (I) were stable. Admixture of (I) causes a large decrease of the positive V_0 of (II); higher concns. of (I) cause V_0 to become negative but the negative effect disappears if the surface area is increased. Similar curves were obtained with (II) and $Br\text{·}[CH_2]_{12}\text{·}CO_2H$, $Br\text{·}[CH_2]_{14}\text{·}CO_2H$, and $I\text{·}[CH_2]_{14}\text{·}CO_2H$, and with cetyl alcohol and $Br\text{·}[CH_2]_{14}\text{·}OH$. Addition of these ω-compounds causes a gradual transition from a condensed to an expanded film. The effective dipole moments of each C·Br linking, $\mu = (V_0 - V_1)/4\pi n$, where V_1 is the surface potential of the mixed film, V_0 that of the pure components, and n is the no. of mols. of ω-compound per sq. cm., have been evaluated. W. R. A.

Layers of grains on mercury. Possibility of realising, on the thin layers, the three principal dimensions of molecules. H. DEVAUX and L. PALLU (J. Phys. Radium, 1938, [vii], **9**, 441—446).—By depositing on a Hg surface a substance of which the grains are very similar, a layer of single particles can be obtained on which experiments parallel to those made on unimol. layers can be effected. Investigation by this method allows the prediction of various phenomena of unimol. layers. W. R. A.

Electrical conductivity and structure of thin metal films deposited from vapour.—See B., 1939, 56.

Surface tension of dilute solutions. W. C. FISHER and C. A. MACKAY (Canad. J. Res., 1938, **16**, A, 207—214).—Measurements of the change of surface tension with age of surface have been made with lauric acid and with aq. solutions of butyric and lauric acids, Na oleate, and MeOAc. The results support Milner's hypothesis. D. F. R.

Interfacial tensions of some mercury–hydrocarbon oil [systems]. F. A. HEDMAN (Res. Stud. State Coll. Washington, 1938, **6**, 102; cf. A., 1937, I, 300).—The interfacial tension (γ) against Hg for refined medicinal oils is about 365 dynes per cm. at 25° and decreases almost linearly with rise of temp., becoming ~350 dynes per cm. at 125°. For motor oils γ is 339—350 dynes per cm. at 25° but decreases irregularly with rise of temp. For some samples γ is const. or increases between 50° and 75°, but in all cases it decreases very rapidly above 100°. At higher temp. γ for a given motor oil decreases as the period of contact with Hg is prolonged. It is inferred that motor oils are richer in adsorbable components than medicinal oils. J. W. S.

Detergent action of soaps. I. Interfacial tensions of pure soap solutions. B. S. KULKARNI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 395—405).—The relative lowering of interfacial tension between C_6H_6 and H_2O by a series of Na and K soaps has been determined and is found to be systematically > the lowering of γ between H_2O and air. The results are discussed in the light of previous theories and explanations are suggested for the max. activity of Na and K myristates, for increased activity due to unsaturation, presence of OH, and replacement of Na by K, in the soap mol. F. H.

Changes in the contact angle and in the wetting time in the electro-amalgamation of gold. I. N. PLAKSIN and M. A. KOSHUCHOVA (Ann. Sect. Platine, 1938, No. 15, 101—111).—The cosine of the angle of contact of a drop of Hg on a Au foil cathode increases from 0·906 to 0·951 as the potential rises from −0·2 to −2 v., and then gradually falls to 0·883 as the potential rises further to −6·5 v.; the reverse effects are observed with a Au anode. The rate of amalgamation of Au in crushed ores is approx. doubled by connecting the Hg with a cathode (p.d. 2—7 v.), in 0·05% NaCl. R. T.

Cation effect at boundaries of acidoid character. F. SEELICH (Kolloid-Z., 1938, **85**, 268—271) —The influence of electrolytes on the interfacial tension between aq. and non-aq. liquid phases has been measured. Small amounts of alkali or alkaline-earth salts lower the interfacial energy and stabilise the two-phase system; the effectiveness of the cation

increases with increasing valency, and the optimum salt concn. for stabilisation decreases. The effects are reversed at higher salt concns. The rôle of hydration in these phenomena is discussed.

E. S. H.

Physicochemical action of ultrasonic waves. E. HIEDEMANN (Arch. Eisenhüttenw., 1938—9, **12**, 185—193).—A review of recent work. A. R. P.

Results and application of low-temperature research (cryolysis) to colloids. L. HOLZAPFEL (Kolloid-Z., 1938, **85**, 272—278).—Published work, particularly on the changes produced in the state of aggregation and the degree of their reversibility, is reviewed. E. S. H.

Chemical reactions of colloidally dissolved substances. V. Theory of the kinetics of chemical reactions between hydrosols and macrosurfaces. V. N. SKVORTZOV (J. Phys. Chem. Russ., 1938, **11**, 654—663; cf. A., 1936, 1338).—The reaction occurs either on the surface of colloid particles and then depends on the rate of dissolution of the macrosurface in the intermicellar liquid, or on the macrosurface and then depends on the dissolution of the colloid. Kinetic equations for these reactions are given and tested in a reaction between a Ag plate and a Raffo S sol. The real reaction consists of $S_3O_6'' + 2S = S_5O_6''$ and $S_5O_6'' + 4Ag = 2Ag_2S + S_3O_6''$; its rate agrees with the theory. J. J. B.

Colloidal physics of disperse gases. R. AUERBACH (Physikal. Z., 1938, **39**, 875—876).—A review of the possible methods of obtaining gases in a finely disperse state is given. It is possible to obtain colloidal gases by condensation from the mol. state e.g., by chemical, electrochemical, or biological reactions, or by physical changes of state. The effect of surface-active substances is shown.

A. J. M.

Inversion of a three-phase emulsion. J. M. ANDREAS (J. Chem. Educ., 1938, **15**, 523).—When equal vols. of the three layers obtained by shaking xylene, MeOH, and saturated aq. K_2CO_3 are sealed in a test-tube and shaken, the type of emulsion produced depends on the manner of shaking.

L. S. T.

Colloidal Prussian-blue. T. R. BOLAM and W. TAYLOR (Trans. Faraday Soc., 1939, **35**, 268—276).— The peptisation of " insoluble " Prussian-blue by $H_2C_2O_4$ to give stable sols is due to adsorption of $H_4Fe(CN)_6$ on the colloidal particles. $H^{\cdot}$ ions are liberated from the micelles by neutral salts in the order $Cs > K > Na > Li$. The liberation attains a max. val. dependent on the nature of the cation and originates by interchange between salt cations and either H (counter) ions of the adsorbed acid or H ions introduced into the crystal lattice by interaction of $H_2C_2O_4$ and some of the $Fe^{\cdots}$ atoms. The replacing and coagulating powers are in the same order $Pb > Mg > K > Na > Li$. W. R. A.

Properties of colloidal carotene solutions. P. KARRER and W. STRAUS (Helv. Chim. Acta, 1938, **21**, 1624—1636).—The max. in the absorption bands of aq. α-carotene sols vary between 5100 and 4900 A.

and 4650 and 4600 A. respectively. A sol with absorption max. at 4900 A. is yellow and clear, whilst that with max. at 5100 A. is turbid, being green by reflected light and reddish-yellow by transmitted light. The widths and intensities of the bands vary more for aq. solutions than for solutions in org. solvents. In presence of Na cholate max. appear at 5300, 4960, 4610, and 4300 A. On keeping at higher temp. and especially in light the colour of the sols gradually disappears owing to oxidation. The corresponding absorption bands of β-carotene vary between 5100 and 5350 A. and from 4750 to 4880 A. respectively, and the sols vary in colour from yellow to red. These sols are much less sensitive to light and heat than are α-carotene sols. The oxidation of both α and β-carotene sols is retarded by addition of ascorbic acid or lecithin. The effects of additions of these and other materials are discussed.

J. W. S.

Action of hydrochloric acid on colloidal silicic acid. V. N. KRESTINSKAJA and N. E. NATANSON (Acta Physicochim. U.R.S.S., 1937, **7**, 915—936).— The action of HCl as (i) coagulating agent, (ii) stabilising agent, and (iii) peptising agent has been studied on SiO_2 sols. Only conc. HCl produces coagulation. Experiments on transference and cataphoresis show that HCl may abolish, but does not reverse, the charge. Dialysis experiments indicate further that HCl does not promote the disintegration of the micelles. The stabilising action of HCl is attributed to the strengthening of the hydrophilic properties of the sols, which can be due to (a) appearance of freshly formed H_2SiO_3, (b) transition of the H_2SiO_3 to a different form of higher solubility, and (c) removal of charge from the micelles. Addition of small amounts of NaOH increases the η of SiO_2 sols, whilst small additions of HCl reduce it. This is attributed to the effect of electro-viscosity which increases with the dissociation of H_2SiO_3, and decreases when the latter is reduced. W. R. A.

Action of alcohol on colloidal systems containing hydrophilic particles. W. HELLER and E. VASSY (Compt. rend., 1938, **207**, 991—994).— The optical density (δ) of a gelatin sol containing EtOH reaches a const. val. on keeping at a const. temp. (25°) after cooling (10 min. at 6°) much more rapidly than after heating (10 min. at 40°). The δ changes resemble V changes under similar conditions in a sol without EtOH (cf. Heymann, A., 1936, 427); they are ascribed to simultaneous variations of $[H_2O]$ and $[EtOH]$ in the micelles. It is inferred that the appearance of hydrophobic properties on addition of EtOH is due, not to dehydration of the particles, but to absorption of the EtOH.

A. J. E. W.

Stability of organosols. H. ERBRING and K. WENSTÖP (Kolloid-Z., 1938, **85**, 342—350).—The coagulating influence of a series of aliphatic alcohols (C_1—C_8) on sols of polystyrene (I), caoutchouc (II), and cellulose acetate (III) in different org. media has been determined by nephelometric titration. With (III) the coagulating power of the alcohol increases with increasing mol. wt., but the reverse order holds for (I) and (II). Simple relations between the

coagulating power and the dielectric properties of the alcohol and dispersion medium are deduced. E. S. H.

Protective colloids. E. SAUER and W. ALDINGER (Kolloid-Z., 1938, **85**, 295—309).—The adsorption of protective colloids by isodisperse clay suspensions has been determined by separation of the excess of colloid by centrifuging; adsorption isotherms have been established for gum arabic, gelatin, and dextrin. The sedimentation vol. increases with concn. of suspension more slowly than is required for a linear relation, and is greater for large than for small particle sizes. This behaviour is related to the hydration of the clay particles. With increasing concn. of protective colloid, the electrophoretic migration velocity of the protected particles reaches that of the added colloid at a concn. which is also reflected in a change of direction of the sedimentation-vol. curve. Coagulation of the suspensions by electrolytes is accelerated by addition of amounts of colloid < are required for protection. E. S. H.

Colloid chemistry in the service of starch research. M. SAMEC (Kolloid-Z., 1938, **85**, 247—251).—A lecture. E. S. H.

Physical chemistry of starch and bread-making. XXX. Disintegration of paste in two stages ; in the first the X-ray spectrum changes, in the second the starch granules swell. Puffed cereals. J. R. KATZ and J. SEIBERLICH (Z. physikal. Chem., 1938, **183**, 146—152).—The question previously discussed (cf. A., 1934, 843), whether phase changes in the paste precede or are subsequent to swelling, is reviewed, and X-ray experiments are described which support the earlier conclusions. If starch is air-dried at room temp. and then at higher temp., changes take place whereby the H_2O-insol. and slightly turgescible granules become H_2O-sol. The heated starch is less hygroscopic than the untreated starch. The X-ray spectrum of the former, although blurred, is similar to that of the latter, and only by rapid heating to 180—200° is a V spectrum obtained. In the manufacture of puffed cereals the granules are heated rapidly and chilled, steam being removed at the same time to prevent condensation and subsequent pasting of the starch. Puffed cereals give a typical V spectrum. C. R. H.

Swelling and solubility of high-molecular substances. W. L. H. MOLL (Kolloid-Z., 1938, **85**, 335—341).—Experiments with 17 substances in 64 org. media show that the graph obtained by plotting surface tension against the dielectric function μ^2/ε of the medium can be divided into regions representing solubility, swelling, or no change. E. S. H.

Results of ultracentrifuging and diffusion for protein chemistry. T. SVEDBERG (Kolloid-Z., 1938, **85**, 119—128).—A summary of published work, with special reference to the determination of mol. wt. E. S. H.

Significance of viscosity in the elucidation of the structure of colloidal solutions. W. PHILIP-POFF (Kolloid-Z., 1938, **85**, 324—328).—A discussion. E. S. H.

Structure formation in lyophobic sols. I, II. A. I. RABINERSON (Acta Physicochim. U.S.S.R., 1938, **8**, 733—751, 751—762).—I. Structures formed by the disperse phase are compact or spatially extended according to whether lowering of the ζ-potential is general or localised, thus permitting aggregation to occur at all possible points of contact, or at a limited no. only. Thixotropic changes are explained in accordance with this view. Conversion of extended into compact aggregates is illustrated by the gels of benzopurpurin and chrysophenin, which is contrasted with the normal behaviour of Fe_2O_3 and V_2O_5 gels. Since large amounts of liquid are immobilised by aggregates of the first but not by those of the second kind, measurements of η can give no useful information about structure formation when, as frequently happens, a change of structural type is in progress.

II. The formation of extended structures differs from coagulation in being unaccompanied by a permanent decrease of dispersity. It resembles coagulation, however, in being able to occur rapidly when cohesion follows every contact between points of lowered ζ-potential, or slowly when only a fraction of such contacts is effective. Hydration of the disperse phase does not by itself promote the formation of aggregates or the gelation of sols. F. L. U.

Study of transformations in colloidal solutions by simultaneous measurements of optical density and viscosity. A. BOUTARIC (Ann. Soc. Sci. Bruxelles, 1938, **58**, 211—224; cf. A., 1939, I, 23).—The optical density (h) and η/η_0 are related to the mean vol. of the individual particles, and to the total vol. of particles in unit vol. of solution, respectively. $\omega = (1/h)\log_e \eta/\eta_0$, or $(1/h)(\eta - \eta_0)/\eta_0$ in dil. solutions, is ∝ the no. of particles furnished by unit mass of the dispersed substance. ω for horse blood serum remains nearly const. on heating (60—62°), confirming that no change occurs in the degree of dispersion. Dilution of gum arabic (I) sols causes an increase in the no. and size of the particles, corresponding with increased dispersion and hydration. The mean vol. of the (I) particles increases with time and their total vol. is diminished, the rate of change increasing with temp. Addition of electrolytes has a similar effect. A. J. E. W.

Micellar studies explained by example of fine structure of fibres. A. FREY-WYSSLING (Kolloid-Z., 1938, **85**, 148—158).—A lecture. E. S. H.

Hydrosols of pectin and organosols of cellulose esters. S. A. GLIKMAN (J. Phys. Chem. Russ., 1938, **11**, 678—684).—The relative viscosity of aq. pectin solutions increases with concn. and is not affected by additions of EtOH which do not produce gelation. The amount of EtOH required for gelation increases with temp. and the concn. of pectin; it is raised by $Na^{\cdot}$ and lowered by $Ca^{\cdot\cdot}$. The gelation involves no vol. change. These effects are similar to those observed with cellulose esters (cf. A., 1938, I, 573). J. J. B.

Vapour pressure of cellulose ester solutions. A. PAKSCHVER and E. MANKASCH (J. Phys. Chem. Russ., 1938, **11**, 864—870).—Vals. (±10 mm.) are recorded for v.p. of $EtOH-COMe_2$ and $EtOH-Et_2O$ mixtures between 10° and 50°. The v.p. of

EtOH + Et_2O is not appreciably lowered by cellulose nitrate, nor that of $COMe_2$ by the acetate, unless the concn. of the solvent is <40 or 30% respectively.

J. J. B.

Changes of viscosity and sedimentation rate in colloidal solutions. F. FRIMBERGER (Z. ges. exp. Med., 1938, 103, 539—547).—Changes of viscosity and sedimentation rate of colloidal solutions (gelatin 2·5, Na citrate 3·8, H_2O 100) produced by temp. changes and ultra-violet radiation run parallel. The coagulating factor is determined by measuring the viscosity of the solution.

A. S.

Macromolecular compounds. CCIII. Viscosity rule in the cellulose series. H. STAUDINGER and F. REINECKE (Ber., 1938, 71, [B], 2521—2535).— Cellulose Bu and CH_2Ph ethers containing 2·2 alkyl groups per glucose unit were acetylated to eliminate the hydrophilic properties of the residual OH, fractionated, and the $\eta_{sp.}$ of the several fractions in $CHCl_3$ solution was determined. The results, taken in conjunction with those for the Me and Et ethers previously published (A., 1938, II, 265), lead to the same val. for K_m $(10 - 11 \times 10^{-4})$ for all four ethers in the expression $\eta_{sp.} = K_m Pc$ (P = degree of polymerisation, c = concn.), and indicate that the dissolved mols. are linearly extended, and not coiled as is often assumed.

F. L. U.

Structure of non-thixotropic gels of particular hydrophiles. W. HELLER (Compt. rend., 1938, 207, 1046—1048).—The behaviour of mixed gels of gelatin (I) and methylcellulose (II) has been studied. A mixture of 5 g. of (I) and 2·5 g. of (II) in 100 c.c. of H_2O (p_H 6·0) separates into two layers, the lower of which contains the greater amount of (I). If the two layers are separated and each is subjected to temp. variation the lower layer is solid at <20°, whereas the upper is solid at >50°; in fact, they behave approx. as if they were pure (I) or (II). On gradually heating the mixed gel to 23° it is transformed into a sol but reverts to a gel at 48°.

W. R. A.

Viscosity of sols made from X-irradiated apple pectin. C. H. DWIGHT and H. KERSTEN (J. Physical Chem., 1938, 42, 1167—1169).—Irradiation of dry apple pectin powder by soft X-rays greatly reduces the η of a 0·6% sol produced from it. The powder shows no appreciable recovery during 85 days. The effect of the p_H of the sol is $\ll$ that due to irradiation.

J. W. S.

Change in viscosity of starch pastes.—See B., 1939, 90.

Threshold of the structure viscosity of cellulose ester solutions. S. A. GLIKMAN (J. Phys. Chem. Russ., 1938, 11, 825—833).—The viscosity of cellulose nitrate (I) in Bu^aOAc, $PhNO_2$, and $COMe_2$, and of cellulose benzoate (II) in EtOH + C_6H_6, was measured in capillary viscosimeters. A decrease of η from the val. observed at very low pressures appears when the shearing stress exceeds a min. val. which is higher for (II) than for (I) and decreases with increasing particle size and concn. The effects are interpreted on the assumption that the solutions of (I) and (II) contain agglomerates, the rate of destruction of which

is < or > their rate of re-formation at low and high rates of flow respectively.

J. J. B.

Rôle of attractive and repulsive forces in the formation of tactoids, thixotropic gels, protein crystals, and coacervates. I. LANGMUIR (J. Chem. Physics, 1938, 6, 873—896).—The formation of tactoids from thixotropic sols, of Schiller layers from Fe_2O_3 sols, the separation of tobacco virus solutions and bentonite sols into two liquid layers, and the crystallisation of proteins are regarded as being typical of unipolar coacervation involving similarly charged micelles and attractive forces. The previous ideas about Coulombic attraction are shown to give an excessive attractive force between micelles and oppositely charged ions which must be compensated by repulsive forces and by the dispersive action of thermal agitation. Long-range van der Waals forces are discarded and a new theory of coacervation, based on the osmotic pressure, is developed mathematically. A theory of relaxation of birefringence has been worked out according to which the micelles in dil. thixotropic sols of bentonite are arranged normally in a cubic lattice and temporary shear in the liquid orients the micelles and produces birefringence although the lattice remains cubic. In bipolar coacervation, involving micelles of dissimilar charge, the electric fields and the charges on the micelles increase as the micellar concn. increases until at a certain concn. the field attains a val. so high as to cause increased hydration which keeps the micelles apart and confers stability to the coacervate.

W. R. A.

Thixotropy of mineral powders of microscopic size. H. G. F. WINKLER (Kolloid-Beih., 1938, 48, 341—376).—The degree of thixotropy (θ) is conveniently expressed, for purposes of comparison, as the max. val. of the ratio (vol. of liquid)/(vol. of solid) which permits setting to take place in a given time under standard conditions. Using this criterion, a high θ was found for systems of H_2O with a no. of mineral powders in which the particles are laminar or rod-shaped, whilst others of the same grain size but with isometric particles showed none. The latter class may develop a low θ if the grain size is sufficiently reduced. Thixotropy is ascribed to forces acting at right angles to the lattice planes, causing each particle to assume a definite equilibrium position determined by these forces and the opposed Brownian movement. In agreement with this theory a high val. of θ is found to be associated with high sp. surface, whether due to anisometric shape or to fineness of division; further, thixotropy is not usually shown with particles too large to exhibit Brownian movement. Frequently a higher θ is shown by a given powder in org. liquids than in H_2O. The experiments indicate that any solid in a sufficiently fine state of division can form a thixotropic system with a suitable liquid.

F. L. U.

Effect of polyhydric alcohols on time of set of alkaline silica gels. L. A. MUNRO and J. A. PEARCE (Canad. J. Res., 1938, 16, B, 390—395).—Increase in the no. of CH·OH groups in the added alcohol causes a progressive increase in the time of set. The rate of change in the effect produced by increasing concn.

of alcohol varies with the SiO_2 concn. and p_H. With 2·23% gel at p_H 8·2, $(CH_2 \cdot OH)_2$ retards the setting instead of accelerating it, as at higher p_H.
                                                                    D. F. R.

Photographic method for determining small differences in specific volume. R. TAFT and L. E. MALM (J. Physical Chem., 1938, **42**, 1187—1189).— By photographing the meniscus in the capillary neck of a pyknometer before and after setting, it has been shown that a 7·8% gelatin sol contracts by 0·008% on passing into a gel at 30°.   J. W. S.

Supersaturation and Liesegang ring formation. I, II. A. VAN HOOK (J. Physical Chem., 1938, **42**, 1191—1200, 1201—1206).—I. Ag_2CrO_4 readily forms supersaturated solutions in pure H_2O and in H_2O containing gelatin, agar, or bentonite, and these solutions attain equilibrium only slowly, even in presence of seed crystals. The view that supersaturation precedes rhythmic pptn. is supported by the observations that sections of a gel in which a Liesegang ring is about to be deposited show supersaturation on analysis, and that > a definite concn. of like or isomorphous seed crystals prevents the rhythmic pptn., this concn. being independent of the medium. The observations also support the view that the compound to be pptd. in a Liesegang ring is present as a crystalloid and not as a protected colloid. A similar mechanism is suggested for rhythmic pptn. from a melt.

II. The distance (x) through which Liesegang ring formation penetrates decreases rapidly as the no. of nuclei of the ppt. (n) increases. Over wide ranges of n, nx^2 = const. The times required for the appearance of and the distances between the bands indicate that the initial presence of seeds does not alter the nature of the phenomenon.   J. W. S.

Supersaturated solutions of metallic silver. R. E. LIESEGANG (Z. wiss. Phot., 1938, **37**, 218— 220).—$AgNO_3$ forms wide double bands on penetration into a gelatin gel containing $FeSO_4$, and very slowly forms narrow bands in a gel with $Fe(NO_3)_2$, which much later change to wide bands. Further tests appear to confirm the existence of strong supersaturation of Ag.   J. L.

Liesegang rings of uric acid. H. KNÖLL (Kolloid-Z., 1938, **85**, 290; cf. A., 1938, I, 138).
                                                                    E. S. H.

Dispersion of indanthrene dyes in a supersonic field. V. M. ZEZIULINSKI and S. S. TUMANSKI (J. Phys. Chem. Russ., 1938, **11**, 801—804).—In presence of a stabiliser (e.g., saponin) indanthrene dyes are dispersed by supersonic waves, but after switching off the field they often coagulate rapidly. The max. size of a particle after a supersonic treatment is $\propto$ to the concn. of the dye.   J. J. B.

Effect of alkaline soaps, bile salts, and digitonin on mixtures of lecithin and cholesterol. G. VALETTE and R. CAVIER (Bull. Soc. Chim. biol., 1938, **20**, 1256—1264).—The hydrotropic action of alkaline soaps and bile salts on lecithin extends to cholesterol, particularly in presence of lecithin. Na ricinoleate is the soap most active towards lecithin alone. Salts of conjugated bile acids are more effective than Na

cholate, and also than Na ricinoleate if the ratio of cholesterol to lecithin is $\gg 1/9$. The c_H has little effect on the activity of bile salts but Na ricinoleate is more active at p_H 9·2 than 7·4. Digitonin effects a sharper pptn. at p_H 6·8 than 8·0.   P. G. M.

Determination of coagulation. H. A. WANNOW (Kolloid-Z., 1938, **85**, 332—335).—Apparatus and technique, using an infra-red-sensitive photo-electric cell, are described. Results for the coagulation of As_2S_3 sol by alkali cations and its dissolution by NaOH, and the reversal of charge of mastic sol by $ThCl_4$, are reported.   E. S. H.

Electrokinesis with metals. H. R. KRUYT and J. OOSTERMAN (Kolloid-Beih., 1938, **48**, 377—430).— An amplified account of work previously published (A., 1938, I, 398) is given. A device is described by means of which the validity of Smoluchowski's formula for streaming potential with a conducting capillary has been established for a wide range of conductivity ratios.   F. L. U.

Application of Debye–Hückel theory to titration of a mastic sol. R. AUDUBERT (J. Chim. phys., 1935, **35**, 309—313).—The variation of the charge on grains of a mastic sol with [H·] can be deduced from electrophoretic measurements by the Debye–Hückel theory. If this variation is due to an electrochemical phenomenon the dissociation const. of the constituent acids of mastic can be computed, and the vals. so obtained agree substantially with those calc. from the results of electrometric titration.   W. R. A.

Moving-boundary method for determination of cataphoresis of colloids. N. C. SEN-GUPTA (J. Indian Chem. Soc., 1938, **15**, 483—488).—Microscopic and moving-boundary methods give results in entire agreement for the cataphoretic speed of V_2O_5 hydrosol particles. The Kohlrausch and Weber relation for the migration of a boundary between two electrolytes with a common ion and in mixtures of electrolytes has been verified for mixtures of KCl and K iodoeosinate.   C. R. H.

Electrophoretic migration velocity of colloid particles at high field strengths. K. HOFFMANN (Kolloid-Z., 1938, **85**, 328—332).—The sp. velocity for particles of bentonite sols increases linearly with increasing field strength.   E. S. H.

Electrochemistry of platinum sols. III. Positive sols. N. A. BALASCHOVA and N. BACH (Acta Physicochim. U.R.S.S., 1937, **7**, 899—914; cf. A., 1938, I, 29).—The state of the surface of Pt in its sols in various gaseous atm. corresponds with that of the surface of the Pt–gas electrode. Careful oxidation of negative H_2–Pt sols yields positive O_2–Pt sols which, on further oxidation, pass back into negative sols. The state of the surface has been followed by the adsorption of acid. The positive sols cannot be maintained for long at a definite state of surface, oxidation continuing even on saturating the sol with pure N_2. Experiments at different rates of oxidation indicate that the sol particles are not uniform and oxidise with widely differing velocities. Measurement of the cataphoretic velocity of H_2–Pt sols shows that in HCl, the ζ-potential of the particles decreases gradually with increase in concn., whilst in

KOH it increases, then decreases. These data confirm the parallelism between the ζ-potential of the particles and the ε-potential of the interface. The abs. val. of the cataphoretic velocity of positive O_2–Pt sols is of the same order as that of the negative sols.   W. R. A.

Electrophoretic measurements on albumin. A. TISELIUS (Kolloid-Z., 1938, **85**, 129—137).—Apparatus and technique are described.   E. S. H.

Proof that the mass law equations have only one solution. J. ZELDOVITSCH (J. Phys. Chem. Russ., 1938, **11**, 685—687).—A thermodynamic proof is given.   J. J. B.

Constitution and analysis of polymeric phosphoric acids. W. D. TREADWELL and F. LEUTWYLER (Helv. Chim. Acta, 1938, **21**, 1450—1459).—Constitutional formulæ are suggested for $Na_5P_3O_{10}$ and for polymerides of $NaPO_3$, which accord with the strengths of the corresponding acids and their ability to form complexes. A solution of pure $(NaPO_3)_3$ has p_H approx. 7, and this is changed abruptly by addition of a trace of HCl or NaOH, in accord with the fact that $H_3P_3O_9$ is a strong acid and has no tendency to form complexes. A method for determining Na_2CO_3, Na_2HPO_4, and $Na_4P_2O_7$ in commercial $(NaPO_3)_6$ is proposed.   J. W. S.

Free energy of the synthesis of carbamide. A. I. KRASILSCHTSCHIKOV (J. Phys. Chem. Russ., 1938, **11**, 664—669).—Free energy and equilibrium const. of the reactions $CO_2 + 2NH_3 = NH_2 \cdot CO_2NH_4$ and $NH_2 \cdot CO_2NH_4 = CO(NH_2)_2 + H_2O$ are calc. and compared with published experiments.   J. J. B.

Polarimetric and electrometric study of complex tartrates and malates of bivalent metals. J. L. DELSAL (J. Chim. phys., 1938, **35**, 314—326).—The existence in solution of complexes formed by both tartaric and malic acids with Be, Zn, Cd, $Pb^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, $Fe^{\cdot\cdot}$, Ni, Co, and $Mn^{\cdot\cdot}$ is postulated from two sets of polarimetric measurements [(i) neutralisation and (ii) continuous variation methods] and by electrometric measurements.   W. R. A.

Polarimetric and electrometric study of complex tartrates and malates of tervalent and sexavalent metals. J. L. DELSAL (J. Chim. phys., 1938, **35**, 350—365).—Previous evidence is reviewed and further evidence given for the existence in solution of definite complex tartrates and malates of B, Al, $Fe^{\cdot\cdot\cdot}$, Cr, $Mn^{\cdot\cdot\cdot}$, Sb, Bi, As, Mo, W, and U.   F. H.

Hydration of vitamin-B_1.—See A., 1939, III, 74.

Hydration of ions calculated from the electrolytic transport of water. J. BABOROVSKÝ (Coll. Czech. Chem. Comm., 1938, **11**, 542—557).—A crit. review of existing methods of determination of ionic hydration.   F. H.

Ionic equilibria in aqueous solutions of magnesium oxalate. K. J. PEDERSEN (Trans. Faraday Soc., 1939, **35**, 277—283).—From the solubility of CaC_2O_4 in dil. solutions of $MgCl_2$ the formation of complex Mg dioxalate ions has been postulated (cf. Hammarsten, A., 1929, 1229) : $Mg^{\cdot\cdot} + 2(C_2O_4)'' \rightleftharpoons Mg(C_2O_4)_2''$ (i). Conductivity data can be

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interpreted quantitatively by assuming that only undissociated MgC_2O_4 is formed : $MgC_2O_4 \rightleftharpoons Mg^{\cdot\cdot} + C_2O_4''$ (ii). To test if either (i) or (ii) can interpret both sets of data the equilibrium consts. of each have been computed from both sets of data. Only (ii) can explain the experimental results. The dissociation const. of MgC_2O_4 is $3 \cdot 9 \times 10^{-4}$ at infinite dilution. The nature of undissociated MgC_2O_4 is discussed but no definite conclusions regarding it are possible.   W. R. A.

Extent of dissociation of salts in water. VIII. Equation for the mean ionic activity coefficient of an electrolyte in water, and a revision of the dissociation constants of some sulphates. C. W. DAVIES (J.C.S., 1938, 2093—2098).—The equation $-\log f_{\pm} = 0 \cdot 50z_1z_2\{\sqrt{I}/(1 + \sqrt{I}) - 0 \cdot 20I\}$ (where z_1, z_2 are the valencies of the constituent ions, and I is the ionic strength) is proposed for the mean ionic activity coeff. of an electrolyte in H_2O at 25° and at concn. $\not> 0 \cdot 1M$. The relation is in accord with all available data both for completely dissociated electrolytes and, after applying the necessary corrections, for those regarded as incompletely dissociated. The equation, used in conjunction with the experimental activity coeff. for $ZnSO_4$ and $CdSO_4$, leads to dissociation consts. for these salts which accord with the vals. determined from conductivity measurements.   J. W. S.

Dissociating power of salts of fatty acids.—See A., 1939, III, 194.

Dissociation constants of cis- and trans-caronic and norpinic acids. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 373—384).—K_1 and K_2 for cis- and trans-caronic and -norpinic acids have been calc. from potentiometric titration data. The range over which both acid groups titrate simultaneously is 70% with cis-acids and 75% with trans-acids. The vals. found for caronic acid are : (cis) K_1 $2 \cdot 42 \times 10^{-4}$, K_2 $4 \cdot 76 \times 10^{-6}$; (trans) K_1 $2 \cdot 52 \times 10^{-4}$, K_2 $5 \cdot 60 \times 10^{-6}$; and for norpinic acid (cis) K_1 $1 \cdot 47 \times 10^{-4}$, K_2 $2 \cdot 84 \times 10^{-6}$; (trans) K_1 $2 \cdot 66 \times 10^{-4}$, K_2 $5 \cdot 73 \times 10^{-6}$. The distance between the ionising groups calc. from Bjerrum's formula is less in cis- than in trans-acids. The val. of the ratio K_1/K_2 is greater for cis- than for trans-acids and may be used to distinguish them.   F. H.

Is there an essential difference between "ordinary" and "complex" compounds ? J. ZERNIKE (Chem. Weekblad, 1938, **35**, 802—804).—From a review of the literature on complex cations it is concluded that they exist only as ions; they do not form oxides and their electrolytic affinity is small. They either form strong bases (e.g., NH_4OH) or split off an atom of H (e.g., $NH_4 \rightarrow NH_3 + H$).   S. C.

Strength of isomeric complex bivalent platinum bases. D. I. RJABTSCHIKOV (Ann. Sect. Platine, 1938, No. 15, 35—62).—cis-$[Pt,2NH_3(OH)_2]$ (I) behaves as a monoacidic base ($K = 0 \cdot 16 \times 10^{-7}$); the titration curve of the trans-isomeride (II) has two breaks, corresponding with K_1 $0 \cdot 63 \times 10^{-7}$ and K_2 $0 \cdot 125 \times 10^{-10}$. Addition of neutral salts increases the alkalinity of solutions of (I) or (II), as a result of

the reactions (I) or (II) $+ X' \rightleftharpoons$ [Pt,2NH$_3$,X,OH] $+$ OH'; [Pt,2NH$_3$,X,OH] $+ X' \rightleftharpoons$ [Pt,2NH$_3$,X$_2$] $+$ OH' (X, in order of increasing effectiveness $=$ NO$_3$', SO$_4$'', Cl', Br', I', CNS'). Titration of (I) with 0·1N-HCl is represented as (I) $+ 2$HCl $\rightarrow$ [Pt,2NH$_3$,2H$_2$O]Cl$_2$ $\rightleftharpoons$ [Pt,2NH$_3$,2H$_2$O]·· $+ 2$Cl', and of (II) as: (II) $+$ HCl $\rightarrow$ [Pt,2NH$_3$,H$_2$O,OH]Cl $\rightleftharpoons$ [Pt,2NH$_3$,Cl,OH] $+$ H$_2$O $\rightarrow$ [Pt,2NH$_3$,Cl,H$_2$O]OH $\xrightarrow{+ \text{HCl}}$ [Pt,2NH$_3$,Cl$_2$] $+ 2$H$_2$O.   R. T.

Affinity of amino-acids and polypeptides for acids, bases and zwitter ions. S. J. VON PRZY-ŁĘCKI, J. CICHOCKA, E. HOFER, and H. RAFAŁOWSKA (Biochem. Z., 1938, **299**, 230—241).—Neutral NH$_2$-acids interact reversibly with excess of weak org. acid. The salts produced are easily decomposed and do not exist in the solid state. The salts with strong org. acids are more stable. Acid NH$_2$-acids do not yield salts with weak org. acids. Basic NH$_2$-acids yield salts containing NH$_2$-acid and org. acid in the proportions 1 : 1 with weak org. acids, and with strong org. acids yield mol. compounds containing NH$_2$-acid and org. acid in the proportions 1 : 2, 1 : 4, 1 : 6, and 1 : 8. In all cases the decisive factor in salt production is the strength of the org. acid. Neutral NH$_2$-acids yield unstable salts with primary and sec. amines, and salts containing NH$_2$-acid and base in the proportions 1 : 1 with strong bases such as choline and guanidine. Basic NH$_2$-acids yield unstable salts with strong but no salts with weak bases. Acid NH$_2$-acids yield, with amines, salts containing 1 or 2 mols. of amine per mol. of NH$_2$-acid, those with 1 mol. of amine being capable of existence in the solid state. With very weak bases (NH$_2$Ph, C$_5$H$_5$N) these acids form salts containing the constituents in the mol. proportion 1 : 1 only, but with strong bases the proportion is 1 : 1 or 1 : 2 according to the p_{H}. No salts are produced from pairs of acid, basic, or neutral NH$_2$-acids but neutral and acid NH$_2$-acids (glycine and glutamic acid in the mol. proportions 1 : 1) combine as do neutral and basic NH$_2$-acids, some forming salts capable of existing in the solid state. Acid and basic NH$_2$-acids (e.g., lysine and aspartic or glutamic acid) yield 1 : 1, 1 : 2, and 2 : 1 salts.   W. McC.

Solubility of electrolytes. A. H. W. ATEN (Chem. Weekblad, 1938, **35**, 848—852).—A mathematical discussion on the activity factors of ions in solutions of strong electrolytes.   S. C.

Isotonic solutions. I. Chemical potential of water in aqueous solutions of sodium chloride, potassium chloride, sulphuric acid, sucrose, carbamide, and glycerol at 25°. G. SCATCHARD, W. J. HAMER, and S. E. WOOD (J. Amer. Chem. Soc., 1938, **60**, 3061—3070).—Using a modified Sinclair-Robinson apparatus (A., 1934, 1173), the isotonic concns. have been determined for the above solutions, and solubilities at 25° for NaCl, KCl, sucrose, and CO(NH$_2$)$_2$. By means of the measurements a crit. comparison of precise determinations of the chemical potential of H$_2$O has been made, and a standard curve for the osmotic coeffs. of each substance has been obtained.   E. S. H.

Thermodynamics of bi-univalent electrolytes. III. Zinc iodide in aqueous solution. R. G. BATES (J. Amer. Chem. Soc., 1938, **60**, 2983—2990; cf. A., 1938, I, 140).—E.m.f. of the cell Zn–Hg (2-phase)|ZnI$_2$(M)|AgI–Ag have been measured at 5° intervals from 5° to 40°, with 0·005—0·8M-ZnI$_2$. The standard potential of the cell has been evaluated, and the activity coeff. and relative partial mol. heat content and sp. heat of ZnI$_2$ have been calc. ZnI$_2$ behaves as a normal bi-univalent electrolyte in the concn. range studied.   E. S. H.

Activities of copper and cadmium ions in solutions of their benzenesulphonates. (MLLE.) M. QUINTIN (J. Chim. phys., 1938, **35**, 300—308).—A review of previous work (cf. A., 1937, I, 187, 319; 1938, I, 254, 367, 402).   W. R. A.

Activity of the cadmium ion in various organic salts of cadmium. F. KERTÈSZ (J. Chim. phys., 1938, **35**, 367—378).—Determination of the activity of Cd·· electrometrically in solutions of (CCl$_3$·CO$_2$)$_2$Cd, [OH·C$_6$H$_3$(CO$_2$H)·SO$_3$]$_2$Cd,8H$_2$O, and (NH$_2$·C$_6$H$_4$·SO$_3$)$_2$Cd shows that the Debye–Hückel theory applies in solutions of concn. <0·01M. if the complete formula of Gronwall, La Mer, and Greiff is used. The ionic radius for Cd·· is the same in each case studied and does not differ significantly from that recorded for CdCl$_2$ solutions.   F. H.

Graphical representation of the lever law of heterogeneous equilibrium. R. BERTSCHINGER (Z. Metallk., 1938, **30**, 360—366).—Mathematical; geometrical representations of heterogeneous equilibria are illustrated and their construction is described.   A. R. P.

Lodochnikov's method of representing polynary systems. M. RANDALL and B. LONGTIN (J. Physical Chem., 1938, **42**, 1157—1166).—Lodochnikov's method of representation is equiv. to two simultaneous projections on one face of a tetrahedron. Modifications in the method are suggested and its application to the solution of polynary systems are discussed.   J. W. S.

Modified phase rule equation. (A) G. N. COPLEY. (B) S. T. BOWDEN (Nature, 1938, **142**, 958).—A criticism (cf. A., 1938, I, 252) and a reply.   L. S. T.

Equilibria in two-phase, gas–liquid hydrocarbon systems. IV. Methane and heptane. E. H. BOOMER, C. A. JOHNSON, and A. G. A. PIERCEY (Canad. J. Res., 1938, **16**, B, 396—410).—The densities and compositions of both phases in the CH$_4$-n-C$_7$H$_{16}$ solubility equilibrium have been determined at 25°, 55°, and 85° and from 35 to 250 atm. The crit. pressures of complete miscibility were found and the properties of the system are discussed. The N$_2$-n-C$_7$H$_{16}$ system was investigated at 100·9 atm. and from 25° to 115°. The system composed of Viking natural gas and impure C$_7$H$_{16}$ was also investigated at 25°. The systems CH$_4$-C$_5$H$_{12}$, CH$_4$-C$_6$H$_{14}$, and CH$_4$-C$_7$H$_{16}$ are compared and discussed.   D. F. R.

Equilibria in the systems KF–H$_2$O and KHF$_2$–H$_2$O. V. S. JATLOV and E. M. POLJAKOVA (J. Gen. Chem. Russ., 1938, **8**, 774—776).—The solid phases

in the system $KF-H_2O$ are ice, $KF,2$ and $4H_2O$, and KF, and in the system KHF_2-H_2O ice and KHF_2.
R. T.

Determination of the boundary of softening range for the binary system $Na_2B_4O_7-B_2O_3$. A. LEONTEEVA (Acta Physicochim. U.R.S.S., 1937, 7, 937—941).—The transformation temp. t_w have been determined for the system $Na_2B_4O_7-B_2O_3$ by the oscillation method. A sharp max. of t_w observed at 487° corresponds with the binary salt $Na_2O,3B_2O_3$.
W. R. A.

Compound of aluminium bromide with benzene. V. A. PLOTNIKOV and M. M. GRATZIANSKI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 5, 213—224).—The fusion diagram suggests the *compound* $AlBr_3,C_6H_6$, m.p. 37° (decomp.).
R. T.

Stratification in the system sulphuric acid–water–phenol. K. B. SCHVETZOVA (J. Gen. Chem. Russ., 1938, 8, 690—694).—Equilibrium relations at 14° are studied.
R. T.

Certain properties of aqueous ammoniacal solutions as mixed solvents. G. K. DISTANOV (J. Gen. Chem. Russ., 1938, 8, 783—804).—The phase diagrams of the systems $NaX-NH_3-H_2O$ are given, at −40° to 40° for X = Cl, at −50° to 10° for X = Br, and at −50° to 100° for X = I. The solid phases are NaX, $NaX,2H_2O$, $NaX,5NH_3$, $NaBr,xH_2O,yNH_3$, NaI,xH_2O,yNH_3, $NaI,5H_2O$, and ice. The conductivity–composition of solvent curves for saturated solutions of $NaCl$ in 0—100% NH_3, at 0° and 20°, consist of a number of branches, corresponding with formation of different NH_3 hydrates, and with variations in solubility of $NaCl$.
R. T.

Salting-out in microchemical reactions. System antipyrine–water–sodium chloride. B. V. J. CUVELIER (Z. anal. Chem., 1938, 115, 9—14).—Data for the effect of $NaCl$ on the system antipyrine (I)–H_2O are recorded, and discussed in relation to the microchemical salting-out reaction of (I). The effects of KF, $(NH_4)_2SO_4$, and Na_2SO_4 on the system are also shown graphically.
L. S. T.

Relationship of beryllium to the vitriol-forming group and to the alkaline-earth metals. V. IV. Double salt formation between ammonium and beryllium sulphates in comparison with that of the vitriols. I. W. SCHRÖDER [with H. SOHWEDT] (Z. anorg. Chem., 1938, 240, 50—66).—The 0°, 25°, 50°, 75°, and 99·5° isotherms of the ternary system $BeSO_4-(NH_4)_2SO_4-H_2O$ have been determined. The 25° isotherm does not agree with that found by Britton (J.C.S., 1922, 121, 2612). The only double salt is $BeSO_4,(NH_4)_2SO_4,2H_2O$, which is stable above 0°.
F. J. G.

Equilibria in the system $BeSO_4-CuSO_4-H_2O$. A. V. NOVOSELOVA, N. V. BODALEVA, and M. M. GERSCHTEIN (J. Gen. Chem. Russ., 1938, 8, 732—737).—Double salts or mixed crystals are not formed in the system at 30° or 80°. Be is determined iodometrically, by a method based on the reactions: $BeSO_4 + BaCl_2 \rightarrow BeCl_2 + BaSO_4$; $BeCl_2 + H_2O \rightarrow Be(OH)_2 + 2HCl$; $6HCl + 5KI + KIO_3 \rightarrow 3H_2O + 6KCl + 6I$.
R. T.

Ternary systems. V. Phthalic acid, magnesium phthalate, and water. VI. Magnesium phthalate, lithium phthalate, and water. S. B. SMITH and E. C. ELY (J. Amer. Chem. Soc., 1938, 60, 2909—2911).—V. Solubility data for 0°, 25°, and 50° are recorded. The existence of $MgC_8H_4O_4,H_2C_8H_4O_4,8H_2O$, which can be crystallised from aq. solution at ≮50°, is established; at room temp. crystals of $2MgC_8H_4O_4,11H_2O$ are obtained.
VI. Equilibrium data for 25° and 50° are recorded. No evidence of double salt formation has been found.
E. S. H.

System $CaO-SiO_2-H_2O$. A. I. KRJAGOVA (J. Gen. Chem. Russ., 1938, 8, 625—634).—The results of Flint and Wells (A., 1934, 965) are on the whole confirmed. Dissolved SiO_2 is determined by comparing the colour given with H_2MoO_4 with that of standard picric acid solutions.
R. T.

Systems $BaCl_2-BaF_2-H_2O$, $SrCl_2-SrF_2-H_2O$, $CaCl_2-CaF_2-H_2O$, $NaCl-NaF-H_2O$, and $KCl-KF-H_2O$ at 25°. A. N. CAMPBELL and (MRS.) A. J. R. CAMPBELL (Trans. Faraday Soc., 1939, 35, 241—246).—The systems have been investigated by the solubility method. Only one additive compound, $BaCl_2,BaF_2$, is formed and it yields solid solutions with anhyd. $BaCl_2$ and possibly also with BaF_2.
W. R. A.

System ferric oxide–sulphur trioxide–water. F. W. KOERKER and H. N. CALDERWOOD (J. Physical Chem., 1938, 42, 1151—1155).—At 10° $Fe_2(SO_4)_3$ and H_2SO_4 form solid solutions rather than acid salts. At 15° the solid deposited from almost neutral solutions is $Fe_2(SO_4)_3,18H_2O$, whilst in contact with acid solutions the existence of a compound $Fe_2O_3,6SO_3,30H_2O$ is indicated. No basic salts are formed. The concn. of H_2SO_4 required to render Fe insol. is lower at 15° than at 18° or 25°.
J. W. S.

System cobalt chloride–lithium chloride–water. H. BENRATH (Z. anorg. Chem., 1938, 240, 87—96).—The equilibrium diagram for the system between 0° and 100° has been determined. The findings do not agree completely with those of Bassett and Sanderson (A., 1932, 811). There is no anomalous mixed-crystal formation and the formulæ $4LiCl,CoCl_2,10H_2O$ and $2LiCl,CoCl_2,4H_2O$ are preferred to $7LiCl,2CoCl_2,18H_2O$ and $3LiCl,2CoCl_2,6H_2O$ for two of the double salts. The only other double salt is $LiCl,CoCl_2,2H_2O$, as found by Bassett and Sanderson.
F. J. G.

System cobalt chloride–sodium chloride–water between 25° and 100°. A. BENRATH and E. NEUMANN (Z. anorg. Chem., 1938, 240, 80—86).—The equilibrium diagram for the system has been determined. There are no double salts.
F. J. G.

System cobalt bromide–ammonium bromide–water between 0° and 100°. A. BENRATH and B. SCHIFFERS (Z. anorg. Chem., 1938, 240, 67—79).—The equilibrium diagram for the system between 0° and 100° has been determined. The vals. for the solubility of NH_4Br in g. per 100 g. of H_2O are represented by $59·5 + 0·732\theta$, which agrees with the results of other workers. The vals. for the solubility of $CoBr_2$ are > those of Étard (A., 1894, ii, 442). $CoBr_2,6H_2O$ is stable up to 43°, $CoBr_2,4H_2O$ from

43° to 60°, and $CoBr_2,2H_2O$ above 60°. The only *double salt* is $CoBr_2,2NH_4Br,2H_2O$, which is stable above 40° and forms incongruent solutions at all temp. <105°.   F. J. G.

System iron–iron sulphide–vanadium sulphide–vanadium. R. VOGEL and A. WÜSTEFELD (Arch. Eisenhüttenw., 1938–9, **12**, 261—268).—V and VS form a eutectic at 1312°, 12% S and FeS and VS give a continuous series of solid solutions without a min. m.p. The section Fe–FeS–VS–V can be divided into two parts; in the first Fe–V solid solution with >5% V is in equilibrium with VS and in the second Fe–V solid solution with <5% V is in equilibrium with FeS–VS solid solution. VS is appreciably sol. in Fe–V solid solution.   A. R. P.

Heats of formation of cuprous and mercurous halide compounds with amines. W. HIEBER and E. E. FEDER (Z. Elektrochem., 1938, **44**, 881—887).—Mol. heats of formation at 20° from solid halide and liquid or (in parentheses) gaseous amine are: $CuCl_2,2C_5H_5N$ 28·15 (47·57), $CuBr_2,2C_5H_5N$ 24·89 (44·31), $CuBr_2,6C_5H_5N$ 45·20 (103·46), $CuCl_2$,en 33·73 (44·93), $CuCl_2$,en$_2$ 52·73 (75·13), $CuBr_2$,en 35·0 (46·2), $CuBr_2$,en$_2$ 56·40 (78·80), $HgCl_2,C_5H_5N$ 11·14 (20·85), $HgCl_2,2C_5H_5N$ 17·22 (36·64), $2HgCl_2,3C_5H_5N$ 8·17 (14·64), $HgBr_2,C_5H_5N$ 9·19 (18·90), $HgBr_2,2C_5H_5N$ 15·45 (34·87), $HgI_2,2C_5H_5N$ 15·22 (34·64), $HgCl_2$,en 27·15 (38·35), $HgBr_2$,en 22·17 (33·37), HgI_2,en 16·14 (27·34) kg.-cal. The dependence of the vals. on the at. vol. of the central atom and on the nature of the halogen is discussed.   E. S. H.

Entropy and energy in solutions or mixtures. J. H. DE BOER (Chem. Weekblad, 1938, **35**, 839—840).—Various theoretical cases of positive and negative entropy change and heats of dissolution or mixing are discussed.   S. C.

Heat of dilution of nitrating mixtures, and the heat effect of nitration processes. A. N. PLANOVSKI (Prom. Org. Chim., 1938, **5**, 686—692).—The heat of dilution of aq. H_2SO_4 is calc. from $q_1 = 183 - 324n/(n + 49)$, and of aq. HNO_3 by $q_2 = 111 - 312n/(n + 98·5)$, where n is the % H_2O content of the acids; for nitration mixtures $q_3 = q_2/(1 - bx)$, where $b = 1 - q_2/q_1$, $x = m/(m + l)$, m is the % of H_2SO_4, and l is that of HNO_3. A formula for heat of nitration is derived.   R. T.

Formation of unstable phases in the course of dehydration of crystalline hydrates. K. G. CHOMIAKOV (J. Phys. Chem. Russ., 1938, **11**, 805—817).—The heat of dehydration of fresh $CuSO_4,5H_2O$ crystals exceeds that of the partly dehydrated crystals by 67 g.-cal. per 1 g. of H_2O. Partly dehydrated $CuSO_4,5H_2O$ evolves 5 kg.-cal. per mol. after the dehydration has been discontinued; the evolution is complete within 1 hr. The heats of dissolution of freshly dehydrated and of old $CuSO_4$ also differ by 5 kg.-cal. Presumably this heat is due to rearrangement of the unstable crystal lattice obtained in the course of dehydration.   J. J. B.

Effect of structure on the reactions of organic compounds. Temperature and solvent in-
fluences. L. P. HAMMETT (J. Chem. Physics, 1938, **6**, 907).—A correction (cf. A., 1936, 1340).   W. R. A.

Kinetic approach to the theory of conductance of infinitely dilute solutions based on the " cage " model of liquids. N. J. POLISSAR (J. Chem. Physics, 1938, **6**, 833—844).—Theoretical. The disparity between the hydrodynamical model of an electrolytic solution and its physical counterpart, the " cage " theory of liquids, the behaviour of an ion under Brownian movement, and the placidly moving ion of the hydrodynamical theory are discussed. Doubt is cast on the validity of the hydrodynamical equations. The desirability of a kinetic theory of electrolytic conductance is stressed and an approach to such a kinetic theory has been made, based on the " cage " model of liquids. The ionic migration is considered as the cumulative effect of a feeble, sporadic, but directed perturbation of the violent but random Brownian movement. The method leads to a relation between the diffusion and the conductivity of an electrolyte and gives an explanation of the high temp. coeff. of slow moving ions. Data have been calc. for the ions of an infinitely dil. aq. solution of KCl.   W. R. A.

Electrolytic conductivity of zinc sulphate and copper sulphate in water at 25°. B. B. OWEN and R. W. GURRY (J. Amer. Chem. Soc., 1938, **60**, 3074—3078).—Conductivities and p_H vals. are recorded, and equiv. conductances for hypothetical unhydrolysed salts calc. for even vals. of $\sqrt{C}$. The limiting equiv. conductances and ionisation consts. for the salts have been estimated by different procedures based on the interionic attraction theory and the law of mass action; the most trustworthy vals. are: $ZnSO_4$, Λ_0 132·8, K 0·0049; $CuSO_4$, Λ_0 133·6, K 0·0043.   E. S. H.

Equivalent conductances of europium chloride and nitrate. I. M. KLOTZ (J. Chem. Physics, 1938, **6**, 907).—Equiv. conductance–(molarity)$^{\frac{1}{2}}$ curves for $EuCl_3$ and $Eu(NO_3)_3$ are nearly identical with those of the corresponding La salts, thus suggesting that $Eu^{\cdots}$ is typical of the rare-earth ions. It is assumed that electrical properties of $Eu^{\cdots}$, revealed by its spectrum, are characteristic also of other rare-earth ions.   W. R. A.

Conductivities of electrolytes in anhydrous acetic acid. B. V. WEIDNER, A. W. HUTCHISON, and G. C. CHANDLEE (J. Amer. Chem. Soc., 1938, **60**, 2877—2879).—Data are recorded for dil. solutions of LiCl, NaCl, KCl, NH_4Cl, $LiNO_3$, $NaNO_3$, KNO_3, $CsNO_3$, NMe_4Cl, NMe_4Br, NMe_3Bu^aBr, and NaOAc in AcOH at 25°.   E. S. H.

Electrochemical study of the system aluminium bromide–sodium bromide–ethyl bromide. V. A. PLOTNIKOV and V. M. DUMAREVSKAJA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 199—212).—The conductivity–[NaBr]/[AlBr$_3$] curves for the system $AlBr_3$–NaBr–EtBr, at 18°, are a series of parabolas, with a max. at [NaBr]/[AlBr$_3$] = 1; a compound, $AlBr_3,NaBr,nEtBr$, is postulated. During electrolysis Al is deposited at the cathode, and Br is evolved at the anode.   R. T.

Conductivity in the systems β-silver sulphide–sulphur and β-silver iodide–thallium iodide, at 25° and 35°. V. P. TSCHALI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 231—237).—The sp. conductivity of compressed mixtures of β-Ag_2S with S and of β-AgI with TlI at 35° is > at 25°. It falls continuously with rising S or TlI content, these substances causing diminution of the no. and mobility of Ag ions.
R. T.

Non-aqueous solutions. I. Conductivity tables. V. A. PLOTNIKOV [with S. I. JAKUBSON], (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 271—358).—Conductivity data are tabulated.　　R. T.

Equation for transference numbers. T. SHEDLOVSKY (J. Chem. Physics, 1938, **6**, 845—846).—A simple transference equation is proposed and agrees well with Longsworth's results on uni-univalent halides (A., 1935, 1078) but does not hold for electrolytes of higher valency nor for abnormal uni-univalent salts such as $AgNO_3$.　　W. R. A.

Mobility of chlorine and magnesium ions in alcohols. F. OLMER (Bull. Soc. chim., 1938, [v], **5**, 1685—1690).—The mobilities at 22° of Cl′ and Mg″ in MeOH and EtOH solutions of $MgCl_2$ and $MgCl_2,6H_2O$ are recorded. The calc. transport no. of Mg in H_2O is 41, intermediate between those of Na and Al. From η data the ionic radii have been calc. Mol. vol. calculations for $MgCl_2$ in alcohols suggest the formation of complexes containing 3 mols. of the alcohol.　　C. R. H.

Transference numbers of lanthanum chloride at 25° by the moving boundary method. L. G. LONGSWORTH and D. A. MacINNES (J. Amer. Chem. Soc., 1938, **60**, 3070—3074).—Data for 0·0075—0·5N. solutions at 25° are recorded. The Cl′ conductances have been compared with those for aq. $CaCl_2$ and NaCl, and an empirical rule for the influence of valency of the co-ion on the Cl′ conductance has been deduced.　　E. S. H.

Degree of hydration of the anion SO_4 derived from electrolytic water transport. J. BABOROVSKÝ (Trans. Electrochem. Soc., 1939, **75**, Preprint 3, 13—18).—Transport no. (T_a) measurements have been made using a four-compartment cell of the type Ag(−), KCl (c)|KCl (c)|K_2SO_4 (c)|K_2SO_4 (c), Ag(+), where c = N. or 0·1N., the solutions being separated by parchment membranes. T_a for SO_4″ is 0·407 and 0·428, and for Cl′ is 0·507 and 0·437, in N. and 0·1N. solution, respectively, the H_2O-transport being 1·95 and 2·48 g.-mol. per Faraday in N. and 0·1N. solution. Assuming the degrees of hydration of K˙ and Cl′ ions in N. solution to be 5 and 4 mols. of H_2O, respectively, the hydration of the SO_4″ ion is 2·8 mols. of H_2O.　　J. W. S.

Thermodynamics of a two-electrode system with retarded ionic transitions in the absence of a current. E. LANGE and K. NAGEL (Z. Elektrochem., 1938, **44**, 856—870).—In continuation of a previous discussion (A., 1939, I, 29) several simple electrode processes are considered, in which ionic transitions are partly or completely inhibited. The systems are treated from the point of view of " potential deficit " (difference between actual potential and that corresponding with true electrochemical equilibrium), and possible modes of experimental study are indicated.　　F. L. U.

Behaviour of electrodes in solutions of foreign ions. III. Behaviour of platinum electrodes in solutions containing air. I. L. ORESTOV (J. Phys. Chem. Russ., 1938, **11**, 871—878; cf. A., 1937, I, 364).—The potential of a Pt electrode dipped in a K_2SO_4 or $BaCl_2$ solution changes when $BaCl_2$ or K_2SO_4 respectively is added; in the second case the equiv. point is more clearly observable than in the first. The potential changes linearly with $\log_e$ [Cl′] or $\log_e$ [Ba˙˙].　　J. J. B.

Periodic potential oscillations of tin in CrO_3–HCl solutions. I. M. KARSCHULIN and G. EHRENSVÄRD (Z. Elektrochem., 1938, **44**, 877—881).—The potential of a Sn electrode in aq. CrO_3–HCl undergoes regular periodic changes with time. The influence of composition of the solution on the amplitude and frequency of the periods has been determined. The relation between this phenomenon and the conditions for formation of complexes such as $HSnCl_3$ is discussed.　　E. S. H.

Influence of aqueous suspension of pigments on the potential of certain metals. A. V. PAMFILOV and G. N. KIPARISOV (J. Appl. Chem. Russ., 1938, **11**, 998—1004).—Fe is passivated by aq. suspensions of PbO or minium, and is slightly activated by a no. of common pigments ($PbCrO_4$, Pb or Zn white, lithopone, $PbTiO_3$, PbO, ultramarine, Prussian-blue, ochre, graphite, lampblack). All of these pigments activate Al and Cu surfaces.　　R. T.

Decomposition potential of sodium and potassium halides in ethyl bromide solutions of aluminium bromide. I. S. I. JAKUBSON and V. M. DUMAREVSKAJA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 225—230).—In systems in which $AlBr_3$: MX : EtBr = 1 : 1 : ≮20 (M = Na, K, Li; X = Cl, Br, I), electrolysis results in deposition of alkali metal at the cathode, at a decomp. potential corresponding with that of MX. When $AlBr_3$: MX is ≪1, Al is deposited at the cathode, and the decomp. potential approximates to that of $AlBr_3$.　　R. T.

Oxidation–reduction potentials of unstable organic systems. A. E. CAMERON (J. Physical Chem., 1938, **42**, 1217—1227).—The oxidation-reduction potentials of metol and of its monosulphonic acid have been measured over a wide p_H range by the discontinuous titration method. At 20° the standard potentials (E_0) are 0·6888 and 0·7292 v., respectively. Introduction of the SO_3H group shifts all ionisations of metol, so that it becomes both a weaker acid and a weaker base. For p-$C_6H_4(OH)_2$ and 1 : 2 : 4-$C_6H_3(OH)_3$ E_0 is ~0·7049 and 0·6014 v., respectively, but extreme precision was found to be impossible owing to the instability of the quinones.　　J. W. S.

Oxidation–reduction potentials of arsenate-arsenite systems in sand and soil media. C. M. KEATON (Res. Stud. State Coll. Washington, 1938, **6**, 99—101).—The redox potential of the system AsO_4″″–AsO_3″″ in presence of pure SiO_2 sand varies with concn. in accord with the theoretical formula, the normal potential at 21° being 0·557 v.

Addition of sandy or clay soil causes irregular results. The presence of $Fe^{...}$ causes oxidation of AsO_3''', but $Al^{...}$ causes only slight fixation of As by adsorption. The beneficial effects of addition of $Fe^{...}$ to soils poisoned by As-sprays are due primarily to fixation of the As by the Fe.   J. W. S.

Redox potential determinations in β-hydroxy-butyric acid–dehydrogenase–acetoacetic acid.—See A., 1939, III, 97.

Calculation of diffusion potentials. A. AIROLA (Svensk Kem. Tidskr., 1938, **50**, 235—239; cf. A., 1938, I, 402).—Mathematical.   M. H. M. A.

Thermic elements. O. K. KUDRA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 245—249).—The e.m.f. developed between a hot and a cold Cu electrode immersed in $CuSO_4$, $Cu(NO_3)_2$, cupricyanide, and cuprammonium solutions may attain vals. of up to 0·12 v., with a temp. gradient of 90°. The charge on the hot electrode is positive in the cases of Cu in $CuSO_4$ or cuprammonium solutions, of Ag in ammoniacal AgCl, of Cd in aq. $CdSO_4$, and of Fe in aq. $FeSO_4$, and negative in the cases of Cu in aq. cupricyanide, Ag in aq. $AgNO_3$, and Fe in aq. $K_4Fe(CN)_6$.   R. T.

Cathodic polarisation in electrolysis of molten salts. S. A. PLETENEV and V. N. ROZOV (J. Phys. Chem. Russ., 1938, **11**, 641—650).—Oscillograph measurements show that the polarisation of a Pb cathode in molten $PbCl_2$ at 400° or 500° is $<10^{-3}$ v.; in mixtures of $PbCl_2$ with the eutectic mixture of KCl and LiCl it becomes measurable when $[PbCl_2]$ is $<1·5$ mol.-%. Between 1·5 and 0·2 mol.-% of $PbCl_2$ it is probably a concn. polarisation, and at $[PbCl_2] <0·2$ mol.-% it is very high and probably due to deposition of an alloy. In deposition of Cd from a $CdCl_2$–KCl–LiCl mixture the polarisation is $>2 \times 10^{-3}$ v. even at $[CdCl_2] = 47$ mol.-%; it is presumably due to the low rate of dissociation of the $CdCl_2,4KCl$ complex.   J. J. B.

Reduction of orange-2 and metanil-yellow at the dropping mercury electrode. (MLLE.) H. T. NGA (Compt. rend., 1938, **207**, 989—991, and J. Chim. phys., 1938, **35**, 345—349).—Polarograph experiments show that reduction, which occurs between p_H 1 and 13, requires two H atoms per mol. in each case. Rupture of the mols. does not occur, substituted hydrazines being formed.   A. J. E. W.

Electrolytic reduction potentials of organic compounds. XXVII. Furfuraldehyde. I. TACHI (J. Agric. Chem. Soc. Japan, 1938, **14**, 1371—1374; cf. A., 1939, I, 29).—The standard electrolytic reduction potential, Π_0', and saturation current of furfuraldehyde (I) at various p_H vals. have been determined by the polarograph method. The saturation current varies with the p_H of the solution and is max. at p_H 8·0. It is suggested that reduction of (I) takes place in two stages continuously from p_H 6 to 8. The Π_0'–p_H curve consists of three linear parts of which the inclinations are $d\Pi_0'/dp_H = -0·07$ at p_H 1 to 6, $-0·03$ at p_H 7 to 10, and 0 at $p_H >10$.   J. N. A.

Streaming of electrolytes in reduction at the dropping mercury electrode. II, III. H. J. ANTWEILER (Z. Elektrochem., 1938, **44**, 888—908;

cf. A., 1939, I, 29).—The influence of various conditions on the direction of streaming has been investigated. The direction depends on the electrolyte accordingly as the deposition potential of the cation is $<$ or $>$ the electrocapillary null potential; it is influenced by the position of the anode, if the latter is close, but is not influenced by a magnetic field. The mechanism of streaming is discussed.   E. S. H.

Electrolytic overpotential phenomena. M. LE-MARCHANDS and W. JUDA (Compt. rend., 1938, **207**, 1192—1194; cf. A., 1938, I, 84).—The H overpotential $(\Delta\epsilon_H)$ at a platinised Pt cathode is expressed by the relation $1 + \Delta\epsilon_H + \frac{1}{2}(\Delta\epsilon_H)^2 = \alpha + \beta d$ (d = c.d.); it is found by experiment that α is const., but $\beta = k/C$, where k is const. and C_1 is the initial $[H^{.}]$. It is deduced that the overpotential is due to a simple ionic attraction effect in the immediate vicinity of the electrode.   A. J. E. W.

Electrolysis of aqueous sulphurous acid.—See B., 1939, 34.

Deflagration and detonation in a combustible gaseous mixture maintained at constant volume. M. VÉRON (Compt. rend., 1938, **207**, 1037—1039).—A new theory of detonation has been developed. Detonation appears always at the end of deflagration and immediately after the max. pressure has been attained by the gas. It is caused by very high pressure at the beginning and rapidly increasing pressure at the end of the deflagration. These factors accentuate the final cooling of the burning gas. The factors which accelerate or impede detonation are different from those which similarly influence self-ignition. Turbulence retards detonation. The influence of pressure, temp., and nature of walls is discussed.   W. R. A.

Propagation of flame in hydrogen–oxygen mixtures. W. E. GARNER and A. PUGH (Trans. Faraday Soc., 1938, **35**, 283—295).—Pressure limits for the propagation of the H_2–O_2 flame have been measured in Pyrex and SiO_2 vessels as a function of the length and diameter of the tube and of the energy of firing. The limit $\propto 1/diameter$. The flame can be propagated down to 0·4 cm. pressure in tubes of 10 cm. diameter. The inability to propagate flame at very low pressures is attributed to wall effects, in which heat is conducted to the walls. This conclusion is supported by studying the effect of inert gases and variation of composition. The rôles of chain carriers and thermal conductivity in the propagation of the flame at atm. pressure are discussed.   W. R. A.

Reaction of hydrogen atoms with carbon tetrachloride. J. E. VANCE and W. C. BAUMAN (J. Chem. Physics, 1938, **6**, 811—818).—Reaction rate consts. at seven temp. between 21° and 200° have been obtained for the reaction $H + CCl_4 = HCl + CCl_3$ in which [H] was determined calorimetrically. The change of reaction rate with temp. follows classical bimol. theory with a steric factor of 0·007 and an activation energy of 3·45 kg.-cal. per mol. Complete conversion of H atoms into HCl may be attained at 150—200°.   W. R. A.

Limits of inflammability of mixtures of propane, air, and nitrogen peroxide. E. B. HODGE

(Ind. Eng. Chem., 1938, 30, 1390—1393).—The limits of inflammability for the above ternary system have been determined under conditions closely similar to those used by Coward and Jones for C_3H_8-air mixtures (B., 1928, 392). The upper limits for ternary mixtures lie on a smooth curve between the upper limit for C_3H_8 and air (13·9% C_3H_8) and the upper limit for C_3H_8 and NO_2 (33·5% C_3H_8). The lower limits for ternary mixtures are on a straight line between the lower limit for C_3H_8 and air (3·6% C_3H_8) and that for C_3H_8 and NO_2 (6·4% C_3H_8).

H. C. M.

Kinetics of cracking of aromatic hydrocarbons under pressure. M. D. TILITSCHEEV and V. K. SCHTSCHITIKOV (J. Gen. Chem. Russ., 1938, 8, 953—968).—Taking the velocity of cracking of $C_{10}H_8$ at 500° as 1, the following velocities are obtained for a series of hydrocarbons : Ph_2 17, phenanthrene 77, $2 : 6\text{-}C_{10}H_6Me_2$ 220, CH_2Ph_2 250, $2\text{-}C_{10}H_7Me$ 300, $CHPh_3$ 420, $1 : 6\text{-}C_{10}H_6Me_2$ 740, fluorene 800, $1\text{-}C_{10}H_7Me$ 1100, acenaphthene 6200, anthracene 10,900, $(CH_2Ph)_2$ 31,000. It is concluded that the readiness with which linkings between C atoms are ruptured diminishes in the order aliphatic–aliphatic > aliphatic–aromatic > aromatic–aromatic C·C. The temp. coeff. of the reaction is 2. R. T.

Mechanism of homogeneous decomposition reactions of simple organic compounds. F. PATAT and L. KÜCHLER (Z. Elektrochem., 1938, 44, 908—909). L. VON MÜFFLING and R. MAESS (ibid., 909—911). F. PATAT and L. KÜCHLER (ibid., 911—912). L. VON MÜFFLING and R. MAESS (ibid., 912).—Polemical. E. S. H.

Kinetics of exchange reactions. H. A. C. McKAY (Nature, 1938, 142, 997—998).—In isotopic exchange reactions, where the isotopes have identical chemical properties, it is not possible to determine the order of the reaction from a concn.-time curve. L. S. T.

Kinetics of the decomposition of dithionic acid. I. Influence of neutral salts and acids on the reaction velocity. II. Comparison of the velocity of decomposition in H_2O and D_2O. H. STAMM and M. GOEHRING (Z. physikal. Chem., 1938, 183, 89—111, 112—120).—I. Halides, sulphates, and dithionates have a negative salt effect. The data, together with data for the effect of strong acids on the reaction velocity, indicate that the reaction is not brought about by S_2O_6'' hydrolysis, but is a H$\cdot$-catalysed reaction according to the scheme : $H\cdot + S_2O_6'' \rightleftharpoons HS_2O_6'$ (preliminary equilibrium); $H\cdot + HS_2O_6' \rightarrow H_2S_2O_6$ (catalysed reaction); $H_2S_2O_6 \rightarrow SO_4'' + 2H\cdot + SO_2$ (decomp. of van 't Hoff intermediate compound).

II. The decomp. velocity is increased by the addition of D_2O. The ratio of the velocity coeffs., k_{D_2O}/k_{H_2O}, is 2·48 and 2·18 at 60° and 100° respectively. On theoretical grounds it is shown that, apart from D$\cdot$ changing equilibrium conditions, a sp. activity is possessed by D$\cdot$. C. R. H.

Spectrophotometric study of the slow hydrolysis of ferric salts. J. CATHALA and J. CLUZEL (Compt. rend., 1938, 207, 781—783).—The $(\log kc)/t$ curves (k = absorption coeff.) for aq. $Fe(NO_3)_3$ at different $\lambda\lambda$ (3865—4157 A.) are parallel, showing that the nature of the absorbing constituent does not change with time (t). The rate of hydrolysis increases rapidly with p_H (5—6), hydrolysis being negligible at p_H <5. The results are in accord with those of Tian (A., 1922, ii, 362) and of Lamb and Jacques (A., 1938, I, 312). A. J. E. W.

Rate of hydrolysis of ethyl acetate in a system of two phases. G. TEDESCHI (Gazzetta, 1938, 68, 652—656).—Velocity measurements of the hydrolysis of EtOAc in the two-phase system EtOAc–aq. HCl at 25 and 35° confirm the theory previously deduced. O. J. W.

Alkylation. VI. Hydrolysis of ethyl chloride by alkalis. V. A. IZMAILSKI and B. V. POPOV (J. Gen. Chem. Russ., 1938, 8, 695—698).—The amount of EtCl hydrolysed at 125° by equiv. concns. of alkalis in 96% EtOH falls in the series NaOH > Na_2CO_3 > CaO > MgO ; the activating effect of H_2O rises in the inverse order. Addition of NaCl to the system EtCl–NaOH–EtOH inhibits hydrolysis, owing to lowered solubility of EtCl and to reversal of dissociation of NaOH. R. T.

Rates of transformation in ethyl alcohol of ammonium and ethylammonium cyanates into the corresponding carbamides. C. C. MILLER and J. R. NICHOLSON (Proc. Roy. Soc., 1938, A, 168, 206—218).—The rates have been measured in the temp. interval 0—32° and in a range of concn. from 0·0002M. to 0·04M. in EtOH containing 1·9% H_2O. Closest distances of approach of the reacting ions are calc. and are found to have a high positive temp. coeff. The Arrhenius equation is not fulfilled except at the highest concn. Solvation of the reactants may play an important part in the transformation of cyanates in H_2O and EtOH at infinite dilution. G. D. P.

Amide hydrolysis with high concentrations of mineral acids. V. K. KRIEBLE and K. A. HOLST (J. Amer. Chem. Soc., 1938, 60, 2976—2980).—The rate for HCO·NH$_2$, NH$_2$Ac, or EtCO·NH$_2$ is a max. at a certain acid concn., which differs according to the amide and is not the same for H_2SO_4 as for HCl. The decrease in rate at higher acid concns. is ascribed to decrease in activity of H_2O. E. S. H.

Course of reaction giving rise to acetylene-bismagnesium bromide. H. KLEINFELLER and H. LOHMANN (Ber., 1938, 71, [B], 2608—2613 ; cf. A., 1932, 172).—The reaction between C_2H_2 and MgEtBr, the velocity of which was measured at 0° and 20°, is unimol. with respect to MgEtBr. The whole process thus consists of two consecutive reactions, viz., (1) C_2H_2 + MgEtBr = CH:C·MgBr + C_2H_6, and (2) $2CH:C·MgBr = C_2H_2 + (:C·MgBr)_2$. The activation energy of the primary reaction is calc. to be ~7500 g.-cal. F. L. U.

Diazotisation and nitrosation of amines. I. Use of dilatometric and conductometric methods. J. C. EARL and N. G. HILLS (J.C.S., 1938, 1954—1958).—The interaction of HNO$_2$ with various sec. amines in MeOH, studied by dilatometric and conductometric methods, seems to follow a course similar to that observed with NHPhMe (A., 1933,

705). The conductivity curves are in accord with the initial formation of a complex which decomposes later with liberation of H˙ ions.   J. W. S.

Inversion of sucrose. P. M. LEININGER and M. KILPATRICK (J. Amer. Chem. Soc., 1938, 60, 2891—2899).—The velocity coeff., $k_{H_3O}^+$, has been determined at 0—40° for a wide range of [HCl]. The effect of electrolyte concn. has been investigated; it decreases with rising temp. $k_{H_3O}^+$ increases with rising sucrose concn. The energy of activation calc. from the Arrhenius equation shows that E_A and B decrease with increasing [HCl] and with rising temp. The energy of activation decreases with increasing sucrose concn. An explanation of the results is put forward.   · E. S. H.

Criterion for the mechanism of the reactions of alkyl halides with hydroxylic solvents. Reactions of benzhydryl chloride. L. C. BATEMAN, E. D. HUGHES, and C. K. INGOLD (J. Amer. Chem. Soc., 1938, 60, 3080—3082).—Experiments on the hydrolysis of $Bu^\gamma Cl$ and $CHPh_2Cl$ favour the unimol. mechanism of aliphatic substitution, applying as a criterion a comparison of the rates and product compositions.   E. S. H.

Isomeric change in stilbenes. T. W. J. TAYLOR and (Miss) A. R. MURRAY (J.C.S., 1938, 2078—2086). The rates of change in the liquid state of the less stable geometrical isomerides of $(:CHPh)_2$, $CClPh:CHPh$, and $(:CClPh)_2$ into the equilibrium mixture of each pair of isomerides have been determined at 200°. The heats of activation, which must depend on the nature of the double linkings, are almost the same; since the Cl are unreactive, it appears that there is an interaction between the C·Cl and C:C linkings which would be expected to show itself in the behaviour of the double linking. The Cl-compounds show no acid catalysis, although the change for $(:CHPh)_2$ is sensitive to the presence of traces of acid.   E. S. H.

Reduction of ammonium iridochloride with sugars. I. I. TSCHERNIAEV and V. N. SCHIROKOVA (Ann. Sect. Platine, 1938, No. 15, 63—99).—$(NH_4)_2IrCl_6$ is reduced to $(NH_4)_2[IrCl_5,H_2O]$ by sugars in acid solution. The velocity of reduction $\propto$ concn. of sugar and of HCl, and $\propto$ temp., being 14—15 times as great at 80° as at 60°. The reducing power of sugars varies, 1 mol. of glucose reducing 6, of fructose 7, and of sucrose 13 mols. of $(NH_4)_2IrCl_6$, at 80°, in 4·11N-HCl.   R. T.

Cation effects in concentrated NaCl solution. K. E. THOMÉ (Svensk Kem. Tidskr., 1938, 50, 255—257).—The hydrolysis of the acetyl derivations of glycollic, lactic, hydracrylic, malic, and citric acids by NaOH in aq. NaCl in presence of other cations has been studied. k is in all cases independent of the concn. of reacting ions, and is increased by addition of bivalent ions, $Ca˙˙ > Sr˙˙ > Ba˙˙$. This effect increases with the basicity of the acid. Addition of $CaCl_2$ to give 0·04N. doubles k for dibasic acids, and $CaCl_2$ to give 0·05N. increases k 100 times for tribasic acids.   M. H. M. A.

Epichlorohydrin and hydrogen sulphide. B. SJÖBERG (Svensk Kem. Tidskr., 1938, 50, 250—254).

—The reaction : $CH_2Cl\cdot CH(OH)\cdot CH_2S' \rightarrow$ $OH\cdot CH{<}{}_{CH_2}^{CH_2}{>}S + Cl'$ (in alkaline solution) is unimol. ($k = 0.65 \times 10^{-2}$). With H_2O_2 $CH_2Cl\cdot CH(OH)\cdot CH_2\cdot SH$ gives $CH_2Cl\cdot CH(OH)\cdot CH_2\cdot SO_3H$ [Na salt (I), m.p. 246—247°]. Alkaline hydrolysis of (I) is a bimol. reaction ($k = 3.3$).   M. H. M. A.

Reducing properties of a tautomeric form of geneserine ; a chain reaction.—See A., 1939, II, 40.

Relative reactivities of organometallic compounds. Hydrogenolysis of RM compounds.—See A., 1938, II, 515.

Rate of formation of oximes, phenylhydrazones, and semicarbazones of hydroxy-aldehydes.—See A., 1939, II, 49.

Action of carbon dioxide and of carbon monoxide on manganese. A. N. CAMPBELL and E. A. BROWN (J. Amer. Chem. Soc., 1938, 60, 3055—3060).—The supposed reaction $2Mn + CO_2 = 2MnO + C$ is shown to consist of two consecutive steps : (a) $Mn + CO_2 = MnO + CO$, (b) $Mn + CO = MnO + C$. At temp. $<400°$ (a) predominates almost exclusively, but at higher temp. the rate of (b) increases rapidly and in certain cases may lead to complete removal of CO. The velocities of the reactions depend mainly on the rate of diffusion through the MnO layer. MnO appears to be more pervious to CO_2 than to CO. Both reactions are exothermic, but no reverse reaction was detected up to 600°.   E. S. H.

Velocity of oxidation and vaporisation of mercury, and the obtaining of impermeable films at its surface. V. A. PIANKOV (J. Appl. Chem. Russ., 1938, 11, 931—940).—The rate of vaporisation of Hg $\propto$ the sq. root of the velocity of a stream of air passing over it, but falls with time owing to formation of an impermeable oxide film. Presence of reducing (H_2S, H_2) or acid (HCl, NO_2) gases or of NH_3 in the air increases vaporisation from oxidised surfaces, owing to reduction or decomp. of the film, whilst oxidising gases (I, Cl_2, O_3) have the reverse effect. Vaporisation is least with O_3.   R. T.

Action of hydrochloric acid on noble metals under high pressures of air. V. G. TRONEV and S. M. BONDIN (Ann. Sect. Platine, 1938, No. 15, 113—123).—The rate of dissolution of Pt in HCl rises with increasing [HCl], temp., pressure, and surface of contact; it is considerable for Pt-black in 6N-HCl at 150°/50 atm. Under analogous conditions Au, Pd, Rh, and Ir undergo dissolution in presence of H_2O_2.   R. T.

Decomposition of neutral and basic magnesium carbonates in aqueous medium at the b.p. A. OLIVERIO (Annali Chim. Appl., 1938, 28, 378—383).—The rate of evolution of CO_2 at 100° from Mg carbonates suspended in H_2O (magnesite, $MgCO_3,3H_2O$, and various basic carbonates) is the same. The primary process is considered to be a hydrolysis of $MgCO_3$ in each case.   O. J. W.

Decomposition of organic peroxides. E. J. HARRIS and A. C. EGERTON (Nature, 1938, **142**, 830; cf. A., 1938, I, 256).—EtO_2H decomposes heterogeneously in the range 140—200°, the rate of reaction being in accord with the expression for adsorption obtained from the Langmuir isotherm. The rate of reaction is markedly increased by packing the vessel and by coating the surface with salt. The liquid products contain $MeCHO$ and CH_2O. At higher pressures the decomp. is homogeneous and explosive, and the products are mainly gaseous. At 200°, 60% PrO_2H forms $EtCHO$, C_3H_6, C_2H_4, CH_4, H_2, and CO. EtO_2H and PrO_2H both reduce the induction period in the slow reaction $C_3H_8 + O_2$, but do not affect the subsequent rate of reaction. Their initiating effect can be nullified by poisoning, e.g., with salt, indicating that initiation takes place after a collision of the peroxide with the wall.　　　L. S. T.

Kinetics of decomposition of austenite.—See B., 1939, 48.

Detonation of explosives.—See B., 1939, 107.

Conversion of *para*-hydrogen in presence of nitric oxide in aqueous solution. (Collision number between solute molecules.) L. FARKAS and U. GARBATSKI (Trans. Faraday Soc., 1938, **35**, 263—268).—The rates of conversion of *para*-H_2 catalysed by NO, (i) in the gaseous state and (ii) in aq. solution, have been measured and compared. Rate (ii) is > rate (i). The abs. rate (ii) is satisfactorily explained by the classical theory of collision frequencies in solution, but the theory of collisions in sets (cf. A., 1937, I, 568) leads to disagreement with the experimental data.　　　W. R. A.

Re-esterification of phenolic esters of carboxylic acids .—See A., 1939, II, 64.

Effect of α-substituents on the ammonolysis of esters.—See A., 1939, II, 47.

Distribution factor in catalytic toxicity. E. B. MAXTED and H. C. EVANS (J.C.S., 1938, 2071—2078). —The effective toxicity, based on the total amount of poison present, can be expressed as true toxicity, based on adsorbed concn., by the introduction of a correction termed the distribution factor. This factor approaches unity in the case of poisons having long mean adsorbed lives, corresponding with substantially complete adsorption, but the effective toxicity of substances, for which the partition between the adsorbed and the free phase is low towards the adsorbed side, depends on the individual mol. coverage and on the distribution rates. By determining the effective toxicity and the distribution ratio for several simple poisons towards a Pt catalyst, the true variation of catalytic activity with the actual adsorbed concn. of poison at the catalytic surface has been studied. The results obtained may be interpreted as evidence for the existence of at least two types of potential catalysing or adsorbing elements in the catalyst surface, all elements of a given type being apparently equiv.　　　E. S. H.

Exchange between hydrogen and deuterium on charcoal. R. BURSTEIN (Acta Physicochim. U.R.S.S., 1938, **8**, 857—863).—Exchange between H

and D proceeds rapidly on well degassed C at 500°, 300°, 193°, and 90° K., the activation energy being ∼ 0. The reaction is unimol. with $k = (1/t)\log_e a/(a - x)$, in which a is the concn. of HD in the equilibrium mixture, and x its concn. at time t. The exchange probably occurs by interaction between adsorbed mols. and mols. in the gaseous phase. The results suggest that this exchange and the *para–ortho* conversion proceed by the same mechanism, and throw doubt on the hypothesis of a paramagnetic mechanism of the latter reaction (cf. A., 1933, 680). The failure of previous workers to detect reaction between H and D on C (cf. A., 1934, 1074) was probably due to poisoning of the active centres by residual gas, which the present work shows to be removable only by degassing for several weeks at 900—950°.
　　　F. L. U.

Reaction mechanism of the oxidation of carbon monoxide on the surface of hopcalite. II. Rôle of water bound to the hopcalite on the catalytic process. B. BRUNS (Acta Physicochim. U.R.S.S., 1937, **7**, 875—882; cf. A., 1937, I, 572).— Hopcalite, containing a considerable amount of tightly bound H_2O, is easily reduced in the CO oxidation in presence of excess of O_2, leading to a lowering of its activity. H_2O-free hopcalite, however, obtained by prolonged outgassing at 180°, is more active, and loses its reducing power in the same reaction. The linear dependence on the catalytic activity of the amount of CO oxidised at the expense of surface bound O_2 indicates homogeneity of the active parts of the surface.　　　W. R. A.

Catalytic exchange of gaseous oxygen isotopes. III. Exchange reactions of oxygen atoms between oxygen and water vapour at the surface of copper oxide. N. MORITA and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 656—667; cf. A., 1938, I, 363, 628).—Exchange of O isotopes between O_2 and H_2O vapour on a CuO surface is observable at 650° and very rapid at >750°. CuO prepared by re-oxidation of Cu obtained by reduction of commercial CuO is slightly more active catalytically than the latter. No exchange of O isotopes between O_2 and CuO is observable at temp. ≯900°. Exchange between H_2O vapour and solid CuO is detectable at 650° and rapid at 750°. Hence it is concluded that the catalysed exchange between O_2 and H_2O occurs through an intermediate compound which decomposes into H_2O, O_2, and Cu_2O.　　　J. W. S.

Hydrogenation of simple sulphur compounds. III. Reactions of carbonyl sulphide and methylthiol. B. CRAWLEY and R. H. GRIFFITH (J.C.S., 1938, 2034—2036; cf. A., 1938, I, 363).—Hydrogenation of COS in presence of a Ni subsulphide catalyst has been studied at 125—200°. At temp. >150° the reaction is of first order with respect to COS, but retardation occurs at lower temp. Hydrogenation of MeSH is also of first order with respect to MeSH at 200—300°, but the mechanisms of the reactions are essentially different. It appears unlikely that a mol. of COS held by van der Waals adsorption can react with adsorbed H, and it is suggested that COS reacts simply by collision with adsorbed H. MeSH reacts only when held by activated adsorption, and the slow

rate of this step leads to a considerably smaller relative reaction velocity. E. S. H.

Catalytic oxidation of carbon disulphide and carbonyl sulphide. R. H. GRIFFITH and S. G. HILL (J.C.S., 1938, 2037—2040).—Homogeneous, non-explosive oxidation, with simultaneous production of O_3, occurs when mixtures of air with small amounts of CS_2 are passed through a glass tube at $>140°$. Whilst the homogeneous reaction is difficult to suppress, the heterogeneous reaction which occurs in contact with Ni subsulphide has been studied by adding small amounts of C_2H_4 to the reactants. The heterogeneous reaction is of zero order with respect to CS_2. COS does not undergo homogeneous oxidation so readily; the heterogeneous reaction in contact with Ni subsulphide is of first order with respect to COS, but is retarded by SO_2. The results are discussed in relation to published data on the adsorption of gases by the catalyst. E. S. H.

Selective action of catalysts on the reaction of conversion of fusible formates into oxalates. L. C. FREIDLIN (J. Appl. Chem. Russ., 1938, 11, 975—980).—Of the reactions (i) $Na_2CO_3 + H_2 + CO \leftarrow 2HCO_2Na \rightarrow Na_2C_2O_4 + H_2$ (ii), (i) is catalysed by ThO_2, and (ii) slightly by Cu, and powerfully by $NaNH_2$, in presence of 2—4% of which 80% yields of $Na_2C_2O_4$ are obtained at 240°. R. T.

Kinetics of dehydrogenation of decalin in presence of mixed catalysts. IV. V. I. KARSHEV and Z. A. VASSILIEVA (J. Phys. Chem. Russ., 1938, 11, 670—677; cf. A., 1936, 712).—Three industrial catalysts were used between 350° and 500°. The temp. coeff. was 1·3—1·4 for 10°. J. J. B.

Reactions in concentrated sulphuric acid. V. Influence of temperature on the catalyst. VI. Influence of the material to be oxidised on the catalyst series. J. MILBAUER (Chem. Obzor. 1936, 11, 183—185; Chem. Zentr., 1937, i, 840; cf. A., 1938, I, 406, 526).—V. The following catalyst series for the oxidation of (a) H_2, (b) sucrose with conc. H_2SO_4 were observed; (a) 174°, Pd, Hg, Pt, Se, Ce, Sb, Au, Ni, As, Ag, Cu; 237°, Pd, Hg, Pt, Se, Cu, Ce, Sb, Ag, Au, Ni, As (with increasing temp. the activity of Cu and Ag increases relatively rapidly); (b) 237°, Se, Pd, Hg, Pt, Te, V, Ag, Cu, Sb, [Au, As, Ce, Ni]; 310°, Se, Hg, Cu, Te, Au, V, Pt, Sb, Ce, Ag, As, Pd, Ni.

VI. The corresponding series for (c) CO, (d) CS_2, (e) COS, (f) $FeSO_4$, (g) C_2H_4, are : (c) Pd, Hg, Ag, Pt, V, Se, Au, Cu, As; (d) Pd, Se, Pt, Cu, Te, Hg, Sb, As, Ag; (e) Pd, Pt, Se, Ag, Cu, V, Hg, Te, Sb; (f) Se, Ag, Pd, Pt, Te, Hg, Cu, V, Sb; (g) Se, Pd, Hg, Ag, Pt, Au, V, Te, Cu. A. H. C.

Catalytic oxidation of nitric oxide.—See B., 1939, 36.

Thermal catalysis of carbon monoxide and hydrogen.—See B., 1939, 14.

Copper-chromium oxide catalysts for dehydrogenations.—See A., 1939, II, 6.

Regulation of the catalytic reduction of unsaturated compounds and the ageing phenomena of platinum contacts.—See A., 1939, II, 68.

Electrolysis of aqueous sulphuric acid.—See B., 1939, 34.

Electrodeposition of rubber.—See B., 1939, 80.

Influence of temperature on cathode processes. O. K. KUDRA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 5, 239—243).—The concn. C at which black deposits of Cu or Cd are obtained at the cathode during electrolysis varies according to the formula $C = \alpha\sigma\tau^{\frac{1}{2}}$ (σ = c.c., τ = time elapsed at moment of appearance of the deposit). With rising temp. the val. of C rises, according to the empirical equation $C_\theta = C_0(1 + 0.02156\theta)$. The C–temp. curves are a series of straight lines, the angle of inclination to the x axis of which rises with increasing concn. of the salt. The curves obtained for equiv. concns. of different salts [$CdSO_4$, $Cu(NO_3)_2$] are identical. R. T.

Chemical action of electrical discharges. XVII. Production of acetylene by the electric arc, at various frequencies, in mixtures of methane and hydrogen. E. BRINER, J. DESBAILLETS, and J. P. JACOB (Helv. Chim. Acta, 1938, 21, 1570—1578; cf. A., 1938, I, 407).—Use of a high-frequency discharge permits the maintenance of a stable arc at lower voltage and current than is possible with a low-frequency arc, and improves the yield of C_2H_2 from CH_4–H_2 mixtures. With $n = 10^7$ cycles per sec. a yield of 1 cu. m. per 8·4 kw.-hr. has been attained. Reduction of pressure tends to reduce the yield. J. W. S.

Photosensitised reactions and the quenching of fluorescence in solution. J. WEISS (Trans. Faraday Soc., 1939 35, 48—56).—When the elementary process of quenching and the primary process of a photosensitised reaction are identical, quenching is effected by a radiationless electron transfer in a complex between the excited mol. and the quenching acceptor mol. or ion. Formation of a reduced form of the excited mol. and of an oxidised form of the acceptor results. This chemical reaction has been investigated for various dyes. If O_2 is present the reduced form of the excited mol. is reconverted into dye and the mechanism of the complete reaction can be represented by a cycle. O_2 directly quenches some dyes such as chlorophyll. The results are interpreted in terms of the formation of HO_2 radicals. W. R. A.

Decomposition of water vapour by X-rays. P. GÜNTHER and L. HOLZAPFEL (Naturwiss., 1938, 26, 788).—The absorption of X-rays by H_2O vapour is greatly increased by the addition of Xe (400 mm. Xe to 60 mm. H_2O vapour). After irradiating the mixture it was frozen in liquid H_2, and the pressure of the H_2 remaining over was measured. For each ion pair formed 1 mol. H_2O was decomposed. A. J. M.

Photosensitisation by stannic oxide. C. I. VARADANAM and G. G. RAO (Current Sci., 1938, 7, 231).—On exposure to sunlight in Pyrex flasks, in presence of either hydrated or ignited SnO_2, NH_3 is oxidised to nitrite, KNO_3 reduced to nitrite, and various dyes are decolorised. F. J. G.

Mechanism of the photolysis of [tri]deutero-ammonia. M. BURTON (J. Chem. Physics, 1938, 6,

680—681; cf. following abstract).—A new mechanism proposed for the photolysis of ND_3 involves competition between two spontaneous predissociation processes in the discrete region, viz., (i) $ND_3^* \to ND_2 + D$; (ii) $ND_3^* \to ND + D_2$. The relative rates of (i) and (ii) are 19 : 1. In the diffuse region, the time of decomp. is so short that the reaction proceeds exclusively by (i).   W. R. A.

Competition of predissociation process in the photolysis of polyatomic molecules. G. K. ROLLEFSON and M. BURTON (J. Chem. Physics, 1938, 6, 674—679; cf. A., 1938, I, 499).—Theoretical. The factors governing the probability of decomp. of a photoactivated polyat. mol. by any given path are deduced, and are applied in a discussion of the photolysis of $COMe_2$, $MeCHO$, $AcOH$, HCO_2H, and Pr^aCHO.   W. R. A.

Photochemical addition of bromine to bromobenzene in carbon tetrachloride solution. D. L. HAMMICK, J. M. HUTSON, and G. I. JENKINS (J.C.S., 1938, 1959—1964).—Under the influence of λ 4360 A. addition of Br takes place, although no reaction occurs in the dark at room temp. The course of the reaction is formulated : (1) $PhBr + Br_2 = PhBr_3$ (photo), (2) $PhBr_3 + Br_2 = PhBr_5$ (thermal), (3) $PhBr_5 + Br_2 = PhBr_7$ (thermal). The photo-addition is of low quantum efficiency (0·01—0·005) and unaffected by the presence of O_2. Substitution does not occur.   E. S. H.

Photochemical oxidation of acetone. F. O. RICE and C. E. SCHILDKNECHT (J. Amer. Chem. Soc., 1938, 60, 3044—3047).—The principal over-all reaction at 100°, using the full radiation from a Hg-vapour lamp, is expressed by $COMe_2 + O_2 \to AcOH + CH_2O$, which is followed by the photochemical chain oxidation $CH_2O + O_2 \to H_2O + CO_2$. Small amounts of org. peroxides are also formed. The quantum yield of the oxidation process is about 0·3, approx. 10 times that of the photochemical decomp. in presence of CO_2 in the same system.   E. S. H.

Action of inhibitors on the photochemical autoxidation of iodoform. K. WEBER and V. MAUTNER (Arh. Hemiju, 1938, 12, 172—182).—The velocity of autoxidation of 0·01M-CHI_3 in EtOH, under given conditions, is halved in presence of the following concns. of inhibitors : benzoquinone 34·5, toluquinone 7, thymoquinone 4·5, toluquinol 2·5, o-10·8, m- 14, and p-$C_6H_4(OH)_2$ 4×10^{-5}; PhOH, thymol, $C_{10}H_8$, cyclohexanol, stilbene, and p-$C_6H_4(OMe)_2$ are without effect. The action of the inhibitors depends on removal of energy from activated CHI_3 mols., and not on chemical reaction with oxidation products.   R. T.

Photolysis of β-chloro-β-nitrosobutane. S. MITCHELL and J. CAMERON (J.C.S., 1938, 1964—1968).—Technique for the determination of quantum efficiencies with red light is described; the val. 1·2 has been obtained for the hydrolysis of 2—8% solutions of CMeEtCl·NO in MeOH. The products are HCl, CMeEt:N·OH, and CAcMe:N·OH. The reaction mechanism is discussed.   E. S. H.

Absorption spectrum of the developed photographic image. C. JAUSSERAN (Compt. rend., 1938,

207, 783—786).—The effect of different exposure and development conditions on the absorption spectrum (277—437 mμ.) has been studied. The intensity of the Ag absorption min. at 315 mμ. varies considerably with the development conditions, the min. becoming less pronounced with increasing time of development. A normally developed solarised image gives an absorption curve similar to that of an under-developed normal image, confirming that solarised grains are not completely reduced on development. Images of equal density at a given λ may differ considerably at other $\lambda\lambda$.   A. J. E. W.

Grain-spacing of α-ray, proton, and deuteron tracks in photographic emulsions. T. R. WILKINS and H. J. ST. HELENS (Physical Rev., 1938, [ii], 54, 783—788).—A statistical study of the grain-spacing is described, and a theoretical explanation of observed differences in spacing is given.   N. M. B.

Graininess of photographic layers on irradiation with high-energy quanta. J. EGGERT and E. SCHOPPER (Z. wiss. Phot., 1938, 37, 221—232).—Graininess depends on the grain size, measured by the Callier quotient, and the grain distribution, measured by registering photometer. Emulsions exposed to X-rays show increasing graininess with increasing quantum energy (hard rays). An increase of grain size is thereby demonstrable, together with the probability of local deviations from the mean grain distribution. It is postulated that secondary particles (electrons) from the impact of higher energy quanta may be able to produce developability in the neighbourhood of the initial absorbing point, so that both grain growth and the formation of " islands " of agglomerated particles may occur; this implies that the quantum–grain ratio of 1 represents an average, some quanta being insufficient to cause developability, and some being capable of causing more than one grain to develop. Similar effects are obtainable with exposures to electrons; the nature of α-particle tracks is compared.   J. L.

Photographic sensitivity and the reciprocity law at low temperatures. W. F. BERG and K. MENDELSSOHN (Proc. Roy. Soc., 1938, A, 168, 168—175).—Eastman Process film was tested at 20°, 90°, and 293° K. There is only a small drop of sensitivity between the two lowest temp., and no reciprocity failure occurs. The mechanism of formation of the latent image at low temp. is discussed.   G. D. P.

Carotenoids as photographic sensitisers.—See B., 1939, 105.

Radiochemical decomposition of hydrazine greatly diluted with hydrogen. A. VAN TIGGELEN (Bull. Soc. chim. Belg., 1938, 47, 577—596).—N_2H_4, at concns. of 0·05—0·1% in H_2, is decomposed by radiations from Rn with formation of NH_3 in about 80% yield. The no. of mols. of NH_3 formed by each pair of ions produced by the α-particles increases with [N_2H_4] to a limit of 3. The results are in harmony with the view that decomp. is effected chiefly by H atoms produced by the α-particles, but since both N_2H_4 and H_2S (cf. A., 1937, I, 370, 371) decompose in an atm. of N_2 with a similar ionic efficiency, a

different explanation is possible. A mechanism is suggested. F. L. U.

Chemical action of α-particles from radon on aqueous solutions. F. C. LANNING and S. C. LIND (J. Physical Chem., 1938, **42**, 1229—1247).—α-Rays cause decomp. of H_2O into H_2O_2 and H_2. In experiments with Rn dissolved in H_2O (direct method) and with the Rn in a separate bulb (indirect method) the yields of H_2 were 0·739 and 0·87 mols. per ion pair, respectively. It is concluded that the true yield is 1 mol. per ion pair. Aq. HI is decomposed by α-rays into H_2 and I_2, the yield by the indirect method being 1·86 mols. per ion pair. Aq. HBr is similarly decomposed, the yield by the direct method being 1·187 mols. per ion pair. In pure H_2O, but not in aq. KI, I is converted into HI. Action of α-rays on $KMnO_4$ in N-H_2SO_4 causes formation of $MnSO_4$, the no. of mols. decomposed in the direct method being 0·516 and 0·893 per ion pair in 0·085N- and in 0·893N-$KMnO_4$, respectively. The effects on solutes are attributed to secondary reactions initiated by the decomp. products of H_2O. J. W. S.

Alpha-particle reactions in carbon monoxide, oxygen, and carbon dioxide systems. J. O. HIRSCHFELDER and H. S. TAYLOR (J. Chem. Physics, 1938, **6**, 783—790).—Previously developed methods (A., 1936, 1349) have been extended to O_2, CO, CO_2, and their mixtures. Experimentally known ionisation and excitation processes, and probable neutralisation processes, followed by chemical reactions involving at. species, are adequate to interpret quantitatively the observed experimental results. W. R. A.

Reduction of sulphates and their mixtures by means of methane. M. I. NEKRITSCH (J. Appl. Chem. Russ., 1938, **11**, 885—893).—90% reduction of Na_2SO_4 to Na_2S, and 98% reduction of $BaSO_4$ or $CaSO_4$ to BaS or CaS, is achieved by passing CH_4 over the sulphates at 900° for 1 hr. The effluent gases contain about 0·1% of H_2S, originating chiefly from reaction between H_2O and sulphides. R. T.

Does potassium trioxide exist? S. I. REICHSTEIN and I. A. KAZARNOVSKI (J. Phys. Chem. Russ., 1938, **11**, 743—744).—The rate of the decomp. $K_2O_4 = K_2O_2 + O_2$ shows no peculiarity at the composition K_2O_3, and the v.p. of K_2O_4 remains const. until the solid phase is K_2O_2. Hence K_2O_3 does not exist. J. J. B.

Reaction of potassium sulphate and potassium pyrosulphate with sulphur trioxide. Potassium dipyrosulphate, $K_2S_3O_{10}$. P. BAUMGARTEN and E. THILO (Ber., 1938, **71**, [B], 2596—2603).—SO_3, either as liquid or vapour, reacts exothermally with finely powdered K_2SO_4 below 150° to form *K dipyrosulphate*, $K_2S_3O_{10}$, a hygroscopic cryst. powder giving a characteristic X-ray diagram. The solid dissociates above 150° into SO_3 and $K_2S_2O_7$, and is immediately decomposed by H_2O at room temp. $K_2S_2O_7$ is not formed from K_2SO_4 and SO_3 below 150°, any deficit of SO_3 giving rise to a mixture of $K_2S_3O_{10}$ with unchanged K_2SO_4. Above 150° $K_2S_2O_7$ is the sole product. F. L. U.

Stability of dry potassium ferrocyanide. R. B. LOFTFIELD and E. SWIFT, jun. (J. Amer. Chem. Soc., 1938, **60**, 3083—3084).—$K_4Fe(CN)_6$ is sufficiently stable for precise investigations if not dehydrated at temp. >100°; the dehydrated salt should be kept in the dark, and free from access of atm. H_2O before and during weighing. E. S. H.

Properties of isosteric and similar compounds. —See A., 1939, II, 39.

Basic magnesium carbonate. A. OLIVERIO (Annali Chim. Appl., 1938, **28**, 383—389).—Pptn. of $MgSO_4$ with Na_2CO_3 at room temp. gives $MgCO_3,3H_2O$. Pptn. at 70—80° gives a product $4MgO,3CO_2,4H_2O$ which readily loses CO_2. O. J. W.

Nitride formation with magnesium and aluminium. P. LAFFITTE, E. ELCHARDUS, and P. GRANDADAM (Rev. Ind. min., 1936, 861—867; Chem. Zentr., 1937, i, 39; cf. B., 1935, 554).—N_2 dissociation pressures of Mg_3N_2 (670—727°, 2—3 mm.; 1040°, 67 mm.) have been determined. Pure Mg not previously exposed to air commences to react with N_2 at ∼300°; the reaction velocity increases 66% for a 10° temp. rise. $Mg(N_3)_2$ appears to occur as an intermediate product. A break in the electrical conductivity-θ curve indicates an allotropic change in Mg at 275°. A similar break with Al is due to impurities. A. J. E. W.

Thermal behaviour of compounds important in analysis. II. Calcium and strontium oxalate. B. SAGORTSCHEV (Z. physikal. Chem., 1938, **183**, 153—161).—The decomp. of CaC_2O_4,H_2O (I) and SrC_2O_4,H_2O (II) on heating has been investigated by means of an emanation method. In the case of (I), H_2O begins to be expelled at 150°; if the temp. is maintained at 200° for 1 hr., decomp. into $CaCO_3$ does not take place, and pure CaC_2O_4 is obtained. The latter is very hygroscopic and easily reverts to (I). Decomp. into $CaCO_3$ takes place above 450°, and at 525° an approx. 2·5% decomp. of $CaCO_3$ occurs. Complete decomp. of $CaCO_3$ is obtained at 650—700°, further heating showing no change in wt. The behaviour on heating in CO_2 is similar except that the decomp. of $CaCO_3$ is delayed until 900° is reached. In the case of (II), the expulsion of H_2O and formation of SrC_2O_4 are similar although the latter is not hygroscopic. The decomp. of SrC_2O_4 and $SrCO_3$ takes place respectively at 400—500° and 800—1000°. Data obtained for (II) which has been repeatedly heated to 1000° show that after the first heating some CO_2 remains adsorbed. C. R. H.

Calcium alkali phosphates. R. KLEMENT and P. DIHN (Z. anorg. Chem., 1938, **240**, 40—49).—The work of Franck et al. (A., 1937, I, 92; 1938, I, 319) has been repeated and their findings are not confirmed. The substances described as " carbonate sodium rhenanite " and " α- and β-potassium rhenanite " are respectively $CaNaPO_4$ and $CaKPO_4$, and there is no evidence of a structural change of the latter. " Potassium apatite " is a mixture of β-$Ca_3(PO_4)_2$ with $CaKPO_4$. The existence of "di-calcium carbonate apatite " is doubtful, and in any case the designation " apatite " is incorrect. F. J. G.

Basic phosphates of bivalent metals. III. Barium hydroxyl-apatite. R. KLEMENT and P. DIHN (Z. anorg. Chem., 1938, **240**, 31—39).— $BaHPO_4$ is unaffected by prolonged heating with H_2O. With NaOH it is slowly converted into $Ba_3(PO_4)_2$ (I). Acetate buffers (p_H 4·6) and phosphate buffers at p_H 6·8 and 8·3 have no action. A phosphate buffer at p_H 11·0 slowly affords at 40° $BaNaPO_4,10H_2O$, which readily loses H_2O affording $BaNaPO_4,7H_2O$, but with the same buffer at 90° (I) is slowly formed. (I) as obtained by these methods is always impure, containing a slight excess of PO_4. It is best obtained pure by heating $BaHPO_4$ with $BaCO_3$ in the theoretical proportions to 1000°—1100°. The product of pptn. of $BaCl_2$ with Na_2HPO_4 in presence of NaOH is *Ba hydroxyl-apatite*, $Ba_{10}(PO_4)_6(OH)_2$ (II), and not (I) (cf. A., 1929, 777). Pure (II) may be obtained by heating pure (I) with the theoretical amount of BaO_2 in a moist atm. at 1000°. The product described by Woyczinski (A., 1894, ii, 317) as $Ba_4(PO_4)_2(OH)_2$ is (I) contaminated with $BaCO_3$. (II) has ρ 4·76, and the apatite structure with a 10·19, c 7·70 A. The ratio $c/a = 0·756$ is abnormally high.   F. J. G.

Downward movement of a ring of a precipitate through the particles of a precipitate of a different kind. B. N. SEN (Gazzetta, 1938, **68**, 664—665).—A ring of HgI_2 pptd. on the top surface of a centrifuged layer of insol. sulphate ($BaSO_4$, $PbSO_4$, or $CaSO_4$) descends slowly through the sulphate layer while keeping its ring structure. The velocity of descent is measurable and Liesegang rings are not formed.   O. J. W.

Concentration of carbon of at. wt. 13. P. CAPRON and M. DE HEMPTINNE (Bull Acad. roy. Belg., 1938, [v], **24**, 641—643).—A battery of 51 diffusion pumps of the Hertz type was used to separate $^{12}CH_4$ and $^{13}CH_4$. After 60 hr. working 300 c.c. of CH_4 at a pressure of 2 mm. containing about 50% $^{13}CH_4$ were obtained.   A. J. M.

Hydrolysis of zirconium chloride. L. K. ACHRAP-SIMONOVA (J. Appl. Chem. Russ., 1938, **11**, 941—945).—$ZrCl_4$ yields sol. $ZrOCl_2$ when dissolved in H_2O, and both $ZrCl_4$ and $ZrOCl_2$ are converted by superheated steam into ZrO_2. The distillate obtained by chlorination of eudialite concentrate, consisting of $ZrCl_4$ 46, $FeCl_3$ 16, $AlCl_3 + TiCl_3$ 33, $CaCl_2$ 4·5, and $MgCl_2$ 0·5%, is dissolved in dil. HCl, the solution is filtered, and the filtrate evaporated until the [HCl] = 31·8%. The crystals of $ZrOCl_2,8H_2O$ separating from the cooled solution are washed with 31·8% HCl, and steam is passed at 170—200°, to yield pure ZrO_2.   R. T.

Lead monochloroacetates.—See A., 1939, II, 47.

Constitution of hydroxylamine and its *O*-sulphonic acid. Pyridine *N*-oxide-*O*-sulphonic acid betaine. P. BAUMGARTEN and H. ERBE (Ber., 1938, **71**, [*B*], 2603—2606).—$Fe(OH)_2$ is readily oxidised to $Fe(OH)_3$ not only by NH_2OH and its *N*-Me derivative, but also by its *O*-Me derivative. Since the latter cannot react as NH_2MeO, the oxidation cannot be accepted as proof of the existence of a tautomeric NH_3 oxide form of NH_2OH. Further support for this view is afforded by the observation that typical amine oxides such as NMe_3O and pyridine *N*-oxide are unable to oxidise $Fe(OH)_2$ to $Fe(OH)_3$. Whilst hydroxylamine-*O*-sulphonic acid oxidises HI, pyridine *N*-oxide-*O*-sulphonic acid betaine does not; there is therefore no ground for regarding the former as $NH_3 \cdot O \cdot SO_2 \cdot O$. *Pyridine* N-*oxide*-O-*sulphonic acid betaine* (m.p. 179—180°, slight decomp.) is formed by the action of either SO_3 or $ClSO_3H$ on pyridine *N*-oxide hydrochloride. Details are given.   F. L. U.

Formation and polymerisation of the phosphonitrile radical, PN. H. MOUREU and G. WETROFF (Compt. rend., 1938, **207**, 915—917; cf. A., 1937, I, 146).—Combination of N_2 and P vapour occurs at a W filament at 1500—1800°; $P_4 \rightleftharpoons 2P_2$, $P_2 + N_2 \rightleftharpoons 2PN$. PN radicals diffuse away from the filament, polymerise, and give a deposit of $(PN)_n$ on the walls of the containing vessel (400—500°).   A. J. E. W.

Rôle of phosphates in oxidation processes. VIII. A. MALKOV (J. Gen. Chem. Russ., 1938, **8**, 719—731).—Insol. products are formed with Fe salts and P_2O_7'''' at p_H 5·3, but not at p_H 8·0; formation of these products, and oxidation of Fe^{II} to Fe^{III}, are inhibited by certain org. acid anions, in the order pyruvic > lactic > acetic > succinic acid. These acids also catalyse oxidation of Fe^{II} in presence of PO_4''', as well as the reverse reaction in presence of P_2O_7''''. It is concluded that the action of Fe-containing biocatalysts is regulated by the system $P_2O_7'''' \rightleftharpoons PO_4'''$, and this is in turn controlled by the concn. of metabolites (the above enumerated org. acids) formed.   R. T.

System iodine–vanadium; vanadium di-iodide and tri-iodide. A. MORETTE (Compt. rend., 1938, **207**, 1218—1220).—V and I react in a vac. at >150° giving VI_3, a brownish-black cryst. powder, d 4·2; VI_3 decomposes at ~280°, and VI_2 is obtained as rose-coloured hexagonal plates, d 5·0, by heating in a vac. at 400° for 24 hr. VI_2 with excess of I at 300° gives VI_3. Both compounds are sol. in H_2O, and VI_3 is sol. in EtOH. Atm. oxidation commences at 125—130° in each case. VI_2 gives V_2S_3 with H_2S and VP with P at ~650°. VI_3 reacts readily with Cl_2, giving ICl_3 and VCl_4.   A. J. E. W.

Stability of homœopathic preparations of arsenum iodatum and ammonium iodatum.—See B., 1939, 101.

Double sulphates of bismuth and alkali metals. S. SKRAMOVSKÝ and O. VONDRÁŠEK (Coll. Czech. Chem. Comm., 1938, **10**, 443—452).—The prep. of the *compounds* $K_4Bi_2(SO_4)_5$, $K_8Bi_2(SO_4)_7$, $(NH_4)_9Bi(SO_4)_6$, and $K_9Bi_2(SO_4)_6(NO_3)_3$ is described and the existence of $KBi(SO_4)_2$, $K_3Bi(SO_4)_3$, and $NH_4Bi(SO_4)_2$ confirmed. The unstable, hygroscopic additive *compounds* $KBi(SO_4)_2,2HCl$, $K_4Bi_2(SO_4)_5,4HCl$, and $K_3Bi(SO_4)_3,2HCl$ have been prepared, showing the co-ordination no. of Bi to be 4 in the original compounds.   F. H.

Exchange reaction of oxygen atoms between some inorganic anions and water. T. TITANI and K. GOTO (Bull. Chem. Soc. Japan, 1938, **13**, 667—668).—In neutral solution K_2SO_4 shows no exchange

of O isotopes with H_2O after 100 hr. at 180°, but if a little $KHSO_4$ is added complete exchange equilibrium is attained between the H_2O and the SO_4'' and HSO_4' ions after 20 hr. at 180°. $NaClO_3$ solutions show no observable exchange after 10 hr. at 100°, but considerable exchange occurs in presence of a little HCl. The mechanism of these $H^·$-catalysed exchanges is discussed.　　　J. W. S.

Oxygen exchange during esterification. J. B. M. HERBERT and I. LAUDER (Nature, 1938, **142**, 954—955).—Results obtained by Roberts and Urey (A., 1938, I, 627) support the authors' prediction (*ibid.*, 635) that when esterification of an acid occurs in presence of approx. equal amounts of an alcohol and H_2O an exchange between the O of the H_2O and that of the acid will be observed.　　　L. S. T.

Oxidation of sulphur dioxide with ozone in presence of various concentrations of oxygen. L. I. KASCHTANOV and V. P. RISHOV (J. Gen. Chem. Russ., 1938, **8**, 746—750).—In presence of $MnSO_4$ the no. of mols. of SO_2 oxidised per mol. of O_3 rises from 3 in presence of 5% of O_2 to 4 with 7% O_2, then falls to a min. in 12% O_2, and rises to a second max. (8 mols. SO_2 in 30% O_2). In absence of $MnSO_4$ the first max. is at 5% O_2 (3 mols. SO_2), the min. is at 30% O_2 (1·3 mols. SO_2), and the second max. is at 50% O_2 (3·3 mols. SO_2). Desulphuration of flue gases, with production of H_2SO_4, can be effected by the action of O_3.　　　R. T.

Tellurium tetrafluoride. G. A. R. HARTLEY, T. H. HENRY, and R. WHYTLAW-GRAY (Nature, 1938, **142**, 952).—In a tube of pure, cryst. Al_2O_3 at 200°, TeF_6 is absorbed completely by Te forming colourless needles of TeF_4, which hydrolyse rapidly on exposure to the atm. liberating HF. In glass or SiO_2 tubes, the following reactions take place : $2TeF_6 + Te = 3TeF_4$ and $TeF_4 + SiO_2 = TeO_2 + SiF_4$, and after heating for several days at 200°, the solid formed approximates in composition to TeO_2.　　　L. S. T.

Composition and properties of silicomolybdic acid. E. A. NIKITINA (J. Gen. Chem. Russ., 1938, **8**, 751—758).—$H_8[Si(Mo_2O_7)_6]$ (I) is prepared by acidifying mixtures of aq. Na_2MoO_4 and Na_2SiO_3, by boiling aq. Na_2SiO_3 with MoO_3 and adding H_2SO_4, or by boiling an aq. suspension of SiO_2 gel and MoO_3; the (I) obtained is in some cases contaminated with an acid having $SiO_2 : MoO_3 = 1 : 11$. The solubility of (I) rises from 66·8% at 23·7° to 72·17% at 60°; at 70° (I) dissociates into its components. Tensimetric measurements of (I) suggest the crystal hydrates of (I) with 2·5, 7, 9, 14, 17, and $28H_2O$.　　　R. T.

Precipitation of barium molybdates as a function of p_H. E. CARRIÈRE and (MLLE.) R. LASRI (Compt. rend., 1938, **207**, 1048—1049).—The composition of the ppt. when excess of 10% $BaCl_2$ is added to $M/70$ ammonium paramolybdate, $(NH_4)_6Mo_7O_{24},4H_2O$, varies with p_H. Between 9·4 and 6·8 the composition is $BaMoO_4$; 5·5 and 3·9, $Ba_3Mo_5O_{18}$; 3·4 and 2·4, $Ba_3Mo_8O_{27}$; 1·8 and 1·4, $BaMo_3O_{10}$.　　　W. R. A.

Recovery of laboratory reagents. P. DICKENS (Stahl u. Eisen, 1938, **58**, 1403—1406).—Details of the recovery of Mo from the filtrates and ppts.

obtained in the determination of P in steel in a form suitable for further determinations, the recovery of Ag from solutions or from fixing baths, of I from iodometric titrations, of Sn + Hg from the Zimmermann–Reinhardt method for Fe, are given. The Mo is recovered by pptn. with PO_4''' followed by elimination of the PO_4''' as $MgNH_4PO_4,6H_2O$, the Ag by pptn. as AgCl followed by reduction with Zn, or from fixing baths by pptn. as Ag_2S and ignition in presence of borax, the I by distillation with $K_2Cr_2O_7 + H_2SO_4$, and the Hg + Sn by pptn. as mixed sulphides and distillation of the mixture with CaO. Further purification of the Hg by treatment with NaOH, HCl, dil. HNO_3, and HCl, and finally by distillation (apparatus illustrated) is described.　　　L. S. T.

Decomposition products formed during fusion of sodium paratungstate. V. I. SPITZIN (J. Gen. Chem. Russ., 1938, **8**, 869—875).—Thermal dissociation of $Na_{10}W_{12}O_{41}$ (I) is represented : (I) → $Na_2W_4O_{13} + 4Na_2W_2O_7$ (II). Extraction of the melt with H_2O involves the reaction : 7(II) $+ 32H_2O →$ (I),$28H_2O + 2Na_2WO_4,2H_2O$.　　　R. T.

Potassium uranates. R. FLATT and W. HESS (Helv. Chim. Acta, 1938, **21**, 1506—1512).—Addition of KOH to aq. $UO_2(NO_3)_2$ yields initially the compound $K_2U_7O_{22},xH_2O$, which on addition of excess of KOH is converted into the compound $K_4U_5O_{17},yH_2O$. No trace of $K_2U_2O_7$ was obtained, and it is suggested that this compound is unobtainable by wet methods.　　　J. W. S.

Uranyl salts of substituted organic acids.—See A., 1939, II, 47.

Bromine oxide, Br_2O. R. SCHWARZ and H. WIELE (Naturwiss., 1938, **26**, 742).—Thermal decomp. of BrO_2 gives rise to a white oxide (Br_2O_7 or Br_2O_6?) and a dark brown oxide, Br_2O, which was isolated in the pure form and is identical with the oxide obtained in CCl_4 solution by Brenschede et al. (A., 1936, 576). Br_2O dissolves in CCl_4 with an intense green colour. Mol. wt. determinations in this solution give Br_2O. By prolonged action of Br_2O on CCl_4 the latter is converted into $COCl_2$. With NaOH it gives NaOBr. Br_2O is stable below −40°. It decomposes slowly above this temp. but even at 0° the rate is not rapid.　　　A. J. M.

Preparation of hydriodic acid suitable for alkoxyl and Friedrich–Kjeldahl nitrogen determinations. E. P. CLARK (Ind. Eng. Chem. [Anal.], 1938, **10**, 677).—The prep. of HI by the reduction of I with H_3PO_2 is described. The product gives low " blanks " for these determinations and is stable for a long time. In order to obtain HI suitable for the Zeisel method, the H_3PO_2 must be S-free.　　　L. S. T.

Guiding of reactions by nuclei. Oxidation of iron in ferrous sulphate solution. H. NITSCHMANN (Helv. Chim. Acta, 1938, **21**, 1609—1618).—When a rapid stream of air is drawn through 5% aq. $FeSO_4,7H_2O$ at 50—60° and containing coils of Fe wire filling almost the whole vol. of the solution, a ppt. is obtained after a few hr. X-Ray examination indicates that this consists mainly of microcryst. γ-FeO_2H with a little α-FeO_2H. The process probably comprises oxidation of $Fe^{··}$ to $Fe^{···}$, which is pptd. as

FeO_2H rendering the solution acid and capable of dissolving Fe. After some time the p_H of the solution remains const. at about 3·7. The slow pptn. of FeO_2H permits its arrangement in a crystal lattice. If a suspension of pptd. $Fe(OH)_2$ or $FeCO_3$ is oxidised rapidly with air at 14—18° in presence of $FeSO_4$ a voluminous dark brown ppt. is produced; this, after washing, can be dispersed in H_2O to a sol. This product shows a rather ill-defined γ-FeO_2H X-ray diagram. With a slower rate of oxidation and at higher temp. some α-FeO_2H is also formed, whilst at still higher temp. hydrated Fe_3O_4 is produced. When a suspension of the pptd. FeO_2H is added to aq. $FeSO_4$ and Fe wire before air is passed through the mixture, the product obtained varies from pure γ- to pure α-FeO_2H, according as small or large additions of the suspensions are made. The behaviour is attributed to a change from the γ- to the α-form of FeO_2H in the solid state brought about by contact with dil. $FeSO_4$ solution.   J. W. S.

Preparation of ferric oxide by various oxidative procedures. II. Reaction of ferrous sulphate with potassium chlorate, in aqueous solution. I. RISKIN (J. Appl. Chem. Russ., 1938, **11**, 926—930).—The reaction in neutral solution at 70° is represented : $8FeSO_4 + 1·4KClO_3 + nH_2O \rightarrow 3Fe_2O_3,4·3SO_3,0·7K_2O,6H_6O + 1·4HCl + 0·7H_2SO_4 + Fe_2(SO_4)_3$.   R. T.

New ferromagnetic modification of ferric oxide. O. GLEMSER and E. GWINNER (Naturwiss., 1938, **26**, 739).—By oxidation of Fe^{II} salts in alkaline solution a ferromagnetic Fe_2O_3 is obtained of which the X-ray diffraction pattern differs from that of α- and γ-Fe_2O_3. The elementary cell is hexagonal, a 5·09, c 4·41 A. Heating for 3 hr. at 110° converts it into α-Fe_2O_3. It is proposed to call the new oxide δ-Fe_2O_3.   A. J. M.

Sulphomagnetite. R. S. HILPERT, K. H. MAIER, and A. HOFFMANN (Ber., 1938, **71**, [*B*], 2682—2685).—FeS and Fe_2O_3, heated at 400°, give a magnetic *compound* FeS,Fe_2O_3, d 4·9, with Curie point at 580°, showing a close resemblance to magnetite. The same substance is obtained by heating $FeSO_4$ in H_2 above 550°. The chemical behaviour of the compound is described.   F. L. U.

New ferromagnetic ferric oxides [formed] by hydrolysis of basic ferric chloride. R. S. HILPERT and K. H. MAIER [with A. HOFFMANN] (Ber., 1938, **71**, [*B*], 2676—2681).—Hydrolysis of FeOCl yields non-magnetic hydroxides which lose H_2O at 250° to form Fe_2O_3, the magnetic properties of which depend on the hydrolytic agent used. Thus strongly ferromagnetic products are obtained with 20% NH_3, 20% NaOH, and H_2O at 60°, weakly magnetic with 5% NaOH, and non-magnetic with 5% Na_2CO_3 and H_2O at 100°. All the hydroxides except that obtained with conc. NH_3 were characterised by their X-ray diagrams as α-FeO·OH. The Fe_2O_3 formed by heating may belong to either the α or the γ series according to the temp. of dehydration. No relation is observable between cryst. structure and magnetic properties.   F. L. U.

Structure of iron oxides obtained at low temperatures. M. S. BORUSCHKO and N. F. LASCHKO (J. Phys. Chem. Russ., 1938, **11**, 737—742).—X-Ray patterns of oxide films on 8 specimens of commercial steel and Fe show that in H_2O or wet air γ-Fe_2O_3 is formed; in HNO_3 a Fe^{III} hydroxide, and in flue gas α-Fe_2O_3, is obtained.   J. J. B.

Reaction experiments in the solid state with mixtures of active Fe_2O_3 and CaO. J. A. HEDVALL and S. O. SANDBERG (Z. anorg. Chem., 1938, **240**, 15—20).—The reactivities of various types of Fe_2O_3 towards CaO at various temp. have been compared. Active α-Fe_2O_3 (I) obtained by ignition of $FeSO_4,(NH_4)_2SO_4,6H_2O$, even when coarse-grained, is more reactive than the stable α-Fe_2O_3 obtained by ignition of FeC_2O_4. The difference in reactivity is greatest at 700—800° and becomes zero at 1000°. Fine grinding of (I) causes only a slight increase in reactivity. γ-Fe_2O_3 is more reactive than (I), and the rate of reaction is much greater still when either CaO or $Ca(OH)_2$ is heated with γ-Fe_2O_3,H_2O, and is appreciable even at 300°.   F. J. G.

Corrosion under a drop. V. ZORIN (J. Phys. Chem. Russ., 1938, **11**, 834—843).—Li, K, Na, and NH_4 salts corrode Fe only along the Fe–air–salt solution boundary, and the drops spread in the course of corrosion. Drops of $ZnCl_2$, $CoCl_2$, $AlCl_3$, etc. also corrode along the drop outline but do not spread. Solutions of $MgCl_2$, $BaCl_2$, $MnCl_2$, etc. corrode Fe everywhere under the drop which does not spread. NaOH, $NaNO_3$, $Pb(NO_3)_2$, etc. do not corrode Fe, but NaOH solution spreads readily. A suggested mechanism of corrosion by the first group of salts involves oxidation of Fe·· to Fe··· at the drop contour, an electric current between the contour and the middle of the metal–solution interface, and alkali formation along its contour.   J. J. B.

Sodium cobaltopyrophosphate. (MME.) R. DUVAL and C. DUVAL (Compt. rend., 1938, **207**, 994—996).—Conductometric titration of $CoCl_2$ with $Na_4P_2O_7$ (I) shows that $Co_2P_2O_7$ dissolves in excess of (I) (1 mol.), forming $Na_2CoP_2O_7$. On electrolysis Co migrates to the anode. The blue-violet *salt* $Na_2[CoP_2O_7(H_2O)_2]$ is pptd. on adding EtOH to a mixture of aq. $CoCl_2$ and (I) in the calc. proportions. The complex is unstable in aq. solution. $Na_2[NiP_2O_7(H_2O)_2],4H_2O$ (cf. A., 1936, 1476) is analogous.   A. J. E. W.

Preparation of monochloropentamminocobaltic chloride (purpureocobaltic chloride). W. A. HYNES, L. K. YANOWSKI, and M. SHILLER (J. Amer. Chem. Soc., 1938, **60**, 3053—3054).—A good yield is obtained from $COCl_2,6H_2O$, NH_4Cl, and aq. NH_3, using H_2O_2 as oxidant.   E. S. H.

New compounds of (A) rhodium, (B) iridium, with dimethylglyoxime. V. V. LEBEDINSKI and I. A. FEDOROV (Ann. Sect. Platine, 1938, No. 15, 19—25, 27—34).—(A) (·CMe:N·OH)$_2$ (I) and aq. $Na_3[Rh(NO_2)_6]$ are boiled for 30 min., and excess of NH_4Cl is added, when $NH_4[RhR_2(NO_2)_2],2H_2O$ (R = ·O·N:CMe·CMe:N·OH) crystallises. The corresponding guanidine and [Pt4NH$_3$] *salts* are described.

(B) Aq. $(NH_4)_3IrCl_6$ and (I) yield the *acid* $H[IrR_2Cl_2]$, of which the NH_4 ($+H_2O$), guanidine, K ($+2H_2O$), and $[Pt4NH_3]$ *salts* are described.   R. T.

New series of tervalent iridium ammines. V: V. LEBEDINSKI and N. A. BALITZKAJA (Ann. Sect. Platine, 1938, No. 15, 13—18).—Na_3IrCl_6 or $(NH_4)_3IrCl_6$ and aq. NH_4OAc, when boiled, yield $(NH_4)_2[IrNH_3Cl_5]$; the corresponding K_2, Rb_2, and $[Pt4NH_3]$ *salts* are described.   R. T.

Isomerism of platinum ethylene chlorides. I. I. TSCHERNIAEV and A. GELMAN (Ann. Sect. Platine, 1938, No. 15, 5—12).—Introduction of C_2H_4 into solutions of salts of the type $NH_4[Pt,M,Cl_3]$ ($M = NH_3$, C_5H_5N) leads to production of cis-$NH_4[Pt,M,C_2H_4,Cl_2]$; the corresponding *trans*-salts are prepared from NH_3 or C_5H_5N and $NH_4[Pt,C_2H_4,Cl_3]$.   R. T.

Progress in emission spectrum analysis. R. INTONTI (Chim. e l'Ind., 1938, 20, 726—731).—A lecture dealing with the technique of qual. and quant. spectrographic analysis.   O. J. W.

Influence of size of the sample and the dependence of the line intensities on the excitation conditions on the mean errors in spectrographic analysis. G. THANHEISER and J. HEYES (Arch. Eisenhüttenw., 1938—9, 12, 127—132).—Various sources of error and means for avoiding their effects are discussed at some length.   A. R. P.

Spectral method of determination of molecular composition. V. V. NEDLER (Zavod. Lab., 1938, 7, 795—799).—The relative intensity of given spectral lines depends not only on the concn. of the given element, but also on the volatility of the compound in which it is present. Hence the concn.-intensity curves of different salts of the same element will be displaced, to an extent $\propto$ volatility of the salt, at different arc temp. This is achieved in the cases of Mo and W minerals by constructing pairs of curves given by known concns. of known salts, with Cu and C electrodes, and matching with the curves obtained for a series of dilutions of the unknown; this enables both the concn. and the mol. form of these elements to be determined.   R. T.

Technique of fluorescence analysis. New method of quantitative fluorescence analysis and some cases of its application. M. KONSTANTINOVA-SCHLESINGER (J. Phys. Chem. Russ., 1938, 11, 772—781).—A fluorescent solution is screened, and the thickness of the screen at which the fluorescence becomes invisible is observed. Applications of this method include : (1) determination of acridine (I) in dihydroacridine (II); crystallisation of (II) from EtOH does not affect the amount of (I) in it; (2) determination of $AgNO_3$ by oxidising a solution of (II) by the $AgNO_3$ solution and measuring (I) obtained; and (3) determination of O_2 in commercial N_2 by oxidising fluorescein in alkaline solution.   J. J. B.

Inorganic and organic spot-analysis. F. FEIGL (Chem. and Ind., 1938, 1161—1165).—Eleven examples of drop reactions useful in qual. analysis are described. New tests for (i) reducing substances, (ii) reducing sugars, and (iii) Pd are included. The

test for (i) depends on the reaction that occurs between finely-divided MnO_2 and acid solutions of reducing agents, for (ii) on the conversion of Ag_2O into Ag by glucose, and for (iii) on the reaction between $Pd^{\cdot\cdot}$ and Ni dimethylglyoxime to give the corresponding insol. Pd compound.   L. S. T.

Theory of technical methods of measuring p_H with the glass electrode. H. SAECHTLING (Papier-Fabr., 1938, 36, 508—513).—Details of the measurement of p_H with the glass electrode are discussed. It is not recommended for solutions with p_H vals. outside the range 2·0—8·5, although with care reproducible results can be obtained below 2·0. Above 8·5, however, dissolution of the glass affects the results. The resistance of the glass should be known, especially in relation to temp. variations where these are likely to occur.   D. A. C.

Behaviour of the antimony electrode in p_H measurements. K. FISCHBECK and F. EIMER (Z. Elektrochem., 1938, 44, 845—856).—The potential of the Sb electrode in different buffer solutions has been measured against the saturated Hg–Hg_2Cl_2 electrode at 18°. The influence of streaming velocity, temp., and presence of oxidising and reducing agents has been studied. The results show that the Sb electrode is suitable for p_H measurements under certain conditions, if attention is paid to the oxidation–reduction potential of the test solution. The use of air-saturated solutions is recommended.   E. S. H.

Titration theory of dilute solutions. I. W. ARBATSKY (Z. anal. Chem., 1938, 115, 117—126).—The theory of the titration of dil. solutions is discussed with special reference to the titration of CO_3'' using phenolphthalein (I) or α-naphtholphthalein (II) as indicators. Methods for determining the magnitude of the errors, due to hydrolysis, and for calculating the corrections to be applied are given. Advantages of (II) as an indicator are discussed For the most accurate titration of CO_3'', the vals. obtained using (I) must be corr. or (II) should be used.   L. S. T.

Sulphamic acid as a standard of reference in acidimetry. M. J. BUTLER, G. F. SMITH, and L. F. AUDRIETH (Ind. Eng. Chem. [Anal.], 1938, 10, 690—692; cf. B., 1938, 903).—The suitability of $NH_2\cdot SO_3H$ as a primary standard has been re-examined (A., 1912, i, 444). One recrystallisation from H_2O, according to the method given, and drying in air furnishes a product which is 99·95% pure. The slightly low results as compared with const.-boiling HCl through $Ba(OH)_2$ are due to a trace of occluded H_2O which is not removed at 105° in a vac. $NH_2\cdot SO_3H$ is readily sol. in H_2O and behaves as a strong acid, so that indicators with transition ranges between p_H 4 and 9 can be used. Bromothymol-blue is preferred as indicator since its sharp colour change occurs practically at the experimentally determined equiv. point. The mixed Me-red–methylene-blue indicator gives rapid but less precise results. Aq. $NH_2\cdot SO_3H$ is slowly hydrolysed at room temp. The solid acid is stable. A comparison of the potentiometric titration curves of $NH_2\cdot SO_3H$ with NaOH with those of HCl with $Ba(OH)_2$ shows that sharper breaks over wider p_H ranges are obtained with $NH_2\cdot SO_3H$.

Some of Herboth's conclusions (A., 1925, ii, 155) are vitiated by the use of impure material. The present work shows that $NH_2 \cdot SO_3H$ is a good acidimetric reference substance. L. S. T.

p-Ethoxychrysoidine, a particularly suitable general indicator for acidimetry and alkalimetry, oxidimetry (cerate, permanganate, and bromate), and argentometry. E. SCHULEK and P. RÓZSA (Z. anal. Chem., 1939, **115**, 185—195).— As an indicator for acid–alkali titrations p-ethoxychrysoidine (I) is much less sensitive to CO_2 and H_3BO_3 than is Me-red, but is more sensitive than Me-orange. Borates are best determined with (I) as indicator. (I) can also be used as a redox indicator in titrations with $Ce(SO_4)_2$, $KMnO_4$, and $KBrO_3$. After titration with $KBrO_3$, 5—6 drops of 0·5% α-naphthoflavone (in EtOH) may be added, when, if the titration is correctly completed, one drop of $KBrO_3$ should yield a brown ppt. The indicator can be used in solutions containing $\not> 5\%$ of HCl. (I) can also be used as an adsorption indicator in titration of KI or KCNS with $AgNO_3$. J. W. S.

Volumetric determination of moisture with particular reference to cotton.—See B., 1939, 22.

Azeotropic determination of water in organic liquids.—See B., 1939, 14.

Detection of halogens by spot-tests. C. DUVAL and G. MAZARS (Compt. rend., 1938, **207**, 862—864).— Cl', Br', and I' give a blue spot on paper impregnated with $Ag_4Fe(CN)_6$ and $FeSO_4$ (sensitivity 0·1 μg.; ClO_3', BrO_3', IO_3', S_2O_3'', and the phosphomolybdic anion interfere). Br' and I' give black spots in the following test : a drop of the solution is placed on Ag citrate (I) paper, and the paper is dried, soaked in conc. aq. NH_3, exposed to a 100-c.p. lamp, and developed with metol–quinol (II) (sensitivity 0·5 μg.). Cl' and Br' give black spots with (I) paper on exposure and treatment with conc. aq. $FeSO_4$ followed by aq. NH_3 (sensitivity 0·5 μg.). Cl' and I' give a grey or white spot with AgBr paper after exposure and development with (II). A. J. E. W.

Effect of ions on the Mohr method for chloride determination. Hydrogen peroxide modification for sulphite elimination. R. T. SHEEN and H. L. KAHLER (Ind. Eng. Chem. [Anal.], 1938, **10**, 628—629).—The method is unaffected by SO_4'', PO_4''', SiO_3'', $Fe^{···}$, total alkalinity, total hardness, and colour in quantities present in steam condensates, boiler feed H_2O, and boiler salines. A p_H between 7·4 and 10·8 is also without effect. Large amounts of SO_3'' interfere, and with high $[SO_3'']$ and low $[Cl']$ the error in the determination of Cl' can be serious. Oxidation of SO_3'' by the addition of H_2O_2 with adjustment of p_H overcomes this interference. L. S. T.

Evaluation of the argentometric–potentiometric titration curves of bromide–chloride mixtures. H. FLOOD and E. SLETTEN (Z. anal. Chem., 1938, **115**, 30—37; cf. A., 1936, 1478).—The displacement between the Br' equiv. point and the turning point in the potentiometric titration of Br'–Cl' mixtures is discussed on the assumption that non-homogeneous mixed crystal formation occurs; the Br' end-point should lie in the 15 mv. interval below

the extrapolated Cl' curve, independent of the ratio Br' : Cl'. Curves obtained by plotting potentials at times up to 10 min. after addition of the $AgNO_3$ show that the potentiometric titration curves are unsuitable for the accurate determination of Br'–Cl' mixtures. An empirical table showing the p.d. between the equiv. point of the titration curve and the extrapolated Cl' curve for different Cl'–Br' mixtures is given. L. S. T.

Thermoanalytic method of estimating chlorine in bromine.—See B., 1939, 37.

Volumetric oxidation of iodide and bromide by periodic acid. H. H. WILLARD and L. H. GREATHOUSE (J. Amer. Chem. Soc., 1938, **60**, 2869—2872).— KIO_4 may be used as a primary standard in iodometry. $K_2H_3IO_6$ in slightly alkaline solution and $NaIO_4$ in presence of H_2SO_4 form stable volumetric solutions. In neutral solution $NaIO_4$ decomposes fairly rapidly. I' may be determined in presence of Br' and Cl' by oxidation to IO_3' with standard KIO_4 and titrating the excess of KIO_4 with As_2O_3. Br' may be determined in presence of small amounts of Cl' by oxidation to Br with standard KIO_4, expulsion of Br, and titration of excess of KIO_4. E. S. H.

Determination of free iodine and iodide-iodine together. E. SCHULEK, P. RÓSZA, and M. VON SZILY (Pharm. Zentr., 1938, **79**, 765—770).— Methods of determining I and I' together, e.g., in tincture of I, are compared and three variations of a new argentometric method detailed. (a) The total I is determined by converting free I into NaI with aq. NaOH and H_2O_2, adding $AgNO_3$, and titrating back the excess with KCNS; free I is determined separately with $Na_2S_2O_3$. (b) The free I is determined with $Na_2S_2O_3$ and the resulting solution treated at the b.p. with aq. NaOH and H_2O_2 until $Na_2S_2O_6$ and H_2O_2 have disappeared, acidified with aq. H_2SO_4, and total I determined as in (a). (c) Free I is determined as in (b), the solution is diluted with H_2O, p-ethoxychrysoidine dissolved in EtOH is added followed by aq. NaOH to a slightly alkaline reaction, and the total I titrated directly with $AgNO_3$. K. H. S.

Determination of iodine in thyroid gland powder.—See B., 1939, 102.

Determination of dissolved oxygen in condensed steam.—See B., 1939, 2.

Sulphate titration. Use of tetrahydroxyquinone in a semimicro-method. W. A. PEABODY and R. S. FISHER (Ind. Eng. Chem. [Anal.], 1938, **10**, 651—652).—150 mg. of tetrahydroxybenzoquinone dissolved in 1 ml. of H_2O and diluted with 2 ml. of $OMe \cdot [CH_2]_2 \cdot OH$ provides an indicator solution which, used externally, facilitates the direct titration of small amounts of SO_4'' in solutions coloured by org. matter. Interference due to PO_4''' is re-emphasised. L. S. T.

Conductometric titration of sulphates. G. M. VAINSCHTEIN (Zavod. Lab., 1938, **7**, 778—784).— SO_4'' is determined by electro-titration with standard $Ba(OAc)_2$. R. T.

Balancing of oxidation–reduction equations. K. B. MORRIS (J. Chem. Educ., 1938, **15**, 538—540).—

Rules are given and illustrated by means of equations for the oxidation of $FeSO_4$ by $K_2Cr_2O_7$ in acid solution, the reduction of Ag_3AsO_4 by Zn in acid solution, and the action of $Ba(OH)_2$ on P. L. S. T.

Use in analysis of reactions by added form-aldehyde. I. Detection of acids in presence of known others. II. Quantitative separation of sulphide, sulphate, thiosulphate, and sulphite. A. HEMMELER (Annali Chim. Appl., 1938, **28**, 419—424, 424—427).—I. $Na_2S_2O_3$ and $NaHSO_3$ react with CH_2O to give complexes which show modified pptg. reactions (exemplified in II). CH_2O is therefore used for detection of H_2SO_4, H_3PO_4, HNO_3, HNO_2, AcOH, and $H_2C_2O_4$ in presence of $Na_2S_2O_3$, detection of HI and HBr in presence of H_2SO_3, etc.

II. The mixture is treated with freshly pptd. $CdCO_3$ and the ppt. of $CdS + CdCO_3$ is separated, oxidised (H_2O_2), and SO_4'' determined as $BaSO_4$. Three aliquots of the filtrate are treated respectively by (a) oxidation with H_2O_2 followed by determination of SO_4'' to give $SO_4'' + S_2O_3'' + SO_3''$, (b) addition of $BaCl_2$ in presence of CH_2O, the ppt. being heated in H_2O, filtered, and weighed as $BaSO_4$ [heating the S_2O_3''–CH_2O complex yields SO_4'' (1 mol.) and methylene sulphide (1 mol.)], the wt. of which corresponds with SO_4'' and one half of the S_2O_3''-S, and (c) addition of $BaCl_2$ in presence of CH_2O and acid (which stabilises the S_2O_3''–CH_2O complex), removal of $BaSO_4$ ($\equiv SO_4''$), and then treatment as in (b) to give $BaSO_4 \equiv$ one half of the S_2O_3''-S.
F. O. H.

Conductometric determination of selenious acid with lead ions. R. RIPAN-TILICI (Z. anal. Chem., 1938, **114**, 409—412).—$PbSeO_3$ is pptd. quantitatively at $p_H \sim 8$; this permits the conductometric titration of aq. Na_2SeO_3 with aq. $Pb(NO_3)_2$ at room temp. Data for the titration of 0·1 to 0·002M-Na_2SeO_3 are given. L. S. T.

Potentiometric determination of selenious acid with lead ions using electrodes of the third kind. R. RIPAN-TILICI (Z. anal. Chem., 1938, **114**, 412—415).—The system Hg|HgS–PbS|Pb in presence of a Hg-coated Pt wire and a normal electrode are used. A few particles of a freshly-pptd. mixture of HgS + PbS are added to the aq. Na_2SeO_3, the Pt wire is inserted, and the solution titrated with 0·1M-$Pb(NO_3)_2$. Comparison with the conductometric method (cf. preceding abstract) is given. L. S. T.

Micro-analysis of aërosols. III. Determination of selenium dioxide. D. N. FINKELSCHTEIN (J. Appl. Chem. Russ., 1938, **11**, 1033—1042).—SeO_2 fumes consist of finely dispersed supercooled droplets (up to 100,000 per ml.); the proportion of droplets of diameter $<0·8$ μ. falls from 86% after 2 min. to zero after 10 min. The fumes are best absorbed by a mixture of 50 ml. of 6N-HCl, 3 g. of KBr, and 6 g. of Br; the solution is reduced by Na_2SO_3 in 6N-HCl, to yield a Se hydrosol, the Se content of which is determined nephelo- or colori-metrically. Fe, Cu, and As do not interefere with the determination, but Te should be absent. R. T.

Gravimetric determination of tellurium in basic media. P. BÍLEK (Coll. Czech. Chem. Comm.,

1938, **10**, 430—442).—Accurate determination of Te in alkaline solutions of TeO_3'' and TeO_4'' is possible by reduction to Te'' with $VOSO_4$ followed by atm. oxidation to Te in the presence of NH_2OH or HCO_2Na. Elementary Te is collected, dried at 95°, and weighed. The method is applicable in presence of SeO_4'', AsO_3''', AsO_4'''', MoO_4'', and WO_4'' but SeO_3'', $Pb^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, $Bi^{\cdot\cdot\cdot}$, $Sn^{\cdot\cdot\cdot\cdot}$, $Sb^{\cdot\cdot\cdot}$, and $Sb^{\cdot\cdot\cdot\cdot\cdot}$ interfere. F. H.

Volumetric determination of tellurium. B. S. EVANS (Analyst, 1938, **63**, 874—875).—The method is based on reduction of TeO_4'' to Te by H_3PO_2 in presence of gum arabic, which prevents the formation of a dense ppt., and reoxidation of Te with I at a temp. and under conditions of acidity such that the excess of H_3PO_2 is not attacked by I. The procedure is given in detail, and is shown to be satisfactory for 0·5—10 mg. of Te. E. C. S.

Catalyst for the determination of nitrogen by the Kjeldahl method. R. B. BRADSTREET (Ind. Eng. Chem. [Anal.], 1938, **10**, 696).—Equal parts of $FeSO_4$ and Se are as effective as $CuSO_4 + Se$. The sample is digested in the cold for 15 min. with 35 c.c. of H_2SO_4 containing 1 g. of salicylic acid. 5 g. of anhyd. $Na_2S_2O_3$ are added, and the mixture is heated for 5 min. After cooling, 10 g. of K_2SO_4 and 0·5 g. of the catalyst are added; the mixture is heated until clear, and then for 1 hr. L. S. T.

Use of Raney's alloy in place of Devarda's alloy. E. CATTELAIN and P. CHABRIER (Ann. Chim. Analyt., 1938, [iii], **20**, 285; cf. A., 1934, 1084).—Data given for KNO_3 show that Raney's alloy (30% Ni, 70% Al) gives accurate results for the reduction of NO_3' to NH_3. L. S. T.

Colorimetric determination of very small amounts of nitrate in the form of ammonia. H. SALLINGER and Y. HWANG (Z. anal. Chem., 1939, **115**, 174—177).—20 c.c. of test solution, diluted to 120 c.c., are treated with 1 g. of Devarda's alloy and about 0·5 g. of MgO, and distilled into a 100-c.c. flask containing a few c.c. of H_2O until 20—40 c.c. of distillate are obtained. This is diluted to a suitable vol. and 20 c.c. are treated with 0·8 c.c. of Nessler reagent, comparison being made with solutions containing 1—2 mg. of NH_3 per l. The method permits determination of 0·50—0·02 mg. of N. J. W. S.

Determination of nitrogen trioxide in sulphuric acid.—See B., 1939, 34.

Determination of nitric oxide and nitrogen peroxide in gases from the sulphuric acid industry.—See B., 1939, 34.

Determination of nitrite in waters.—See B., 1939, 109.

Determination of phosphoric acid by titration of the ammonium phosphomolybdate precipitate. W. SPENGLER (Z. anal. Chem., 1938, **114**, 385—405; cf. A., 1938, I, 269).—Various factors, such as time of keeping, method of filtration, temp. of pptn., amounts of wash liquids, etc., affecting the speed and accuracy of the NaOH volumetric method for PO_4''' have been fully investigated using mainly solutions of pure KH_2PO_4. The abnormally high

consumption of alkali found, viz., 57·5 or 58·5 mols. of NaOH per mol. of P_2O_5 instead of the theoretical 56·5 mols., has been traced to the difference in composition of the NH_4 phosphomolybdate pptd. at different temp. At temp. of solution before pptn. $> \sim 85°$, 57·5 mols. of NaOH per mol. of P_2O_5 are required, whilst at temp. $< \sim 85°$, 58·5 mols. are consumed. A procedure which gives satisfactory results with crude phosphates is detailed, but for the most accurate work the gravimetric method described previously (B., 1938, 159) is to be preferred.

L. S. T.

Volumetric determination of phosphoric acid on the basis of Lorenz' method, and the use of reversed titration. L. GISIGER (Z. anal. Chem., 1938, 115, 15—29).—The molybdate methods, and especially that of Lorenz, are discussed. In order to attain a ppt. of const. $P_2O_5 : MoO_3$ the presence of a min. amount of SO_4'' and a marked excess of MoO_4'' is essential. These conditions are fulfilled in Lorenz' method, and, after drying under the prescribed conditions, the ppt. has the composition $[2(NH_4)_3PO_4,24MoO_3]_4NH_4,9MoO_3 +$ adsorbed H_2O and NH_4NO_3. On dissolution in NaOH 50·4 equivs. instead of the theoretical 50·25 are consumed owing to a slight loss of NH_3 during the titration. The effect of washing the ppt. with H_2O, aq. NH_4NO_3, $NaNO_3$, KNO_3, Na_2SO_4, and K_2SO_4 has been investigated. The $K^{\cdot}$ ions replace some of the $NH_4^{\cdot}$ in the ppt. leading to low vals. for P_2O_5 in the titration, but the ppt. is undecomposed by repeated washings with H_2O. Reversed filtration with a filter-stick is recommended, and details of procedure and apparatus are given. An acidimetric method for the determination of P_2O_5 in fertilisers is described.

L. S. T.

Hydrochemical analysis. III. Determination of phosphorus. W. OHLE (Angew. Chem., 1938, 51, 906—911; cf. A., 1936, 577; B., 1936, 1238).—The different forms in which P occurs in natural H_2O are discussed. The Mo-blue method is the best for the determination of P in H_2O, soils, sediments, or plants. Factors affecting the accuracy of this method have been investigated, and the elimination of various sources of error is discussed. The most intense and the most stable blue colour is obtained with 0·25 c.c. of a 1 : 3 mixture of 10% NH_4 molybdate and 50% H_2SO_4, and 0·03 c.c. of $SnCl_2$ solution (corresponding with a [$Sn^{\cdot\cdot}$] of 12·6 mg. per l. of test solution) for 25 c.c. of the test sample. Interference by Fe is prevented by the addition of aq. KCN. For the determination of the total P in H_2O, soils, plants, etc. the P is converted into PO_4''' by oxidation with perhydrol in presence of H_2SO_4, excess of which is subsequently neutralised (p-nitrophenol) with aq. NH_3. The intensification of the Mo-blue colour produced by the $(NH_4)_2SO_4$ is counteracted by addition of N-H_2SO_4. AsO_4''' is reduced by $CS(NH_2)_2$ to AsO_3''' which does not interfere with the PO_4''' determination. Details of both procedures are given.

L. S. T.

Standard determination of phosphorus anhydride by the citrate method. (A) M. I. VOLKOVA, Z. M. GILEVA, B. N. MELENTIEV, and A. S. TERECHOVKO. (B) G. A. MARKOVA and M. L. TSCHE-

PELEVITZKI (Zavod. Lab., 1938, 7, 891—892, 892—893).—(A) The results given by the standard U.S.S.R. method of determination of P_2O_5 in phosphorites, as $Mg_2P_2O_7$, are 0·1—0·9% high, owing to presence of $Ca_3(PO_4)_2$ in the ppt. The method requires revision.

(B) The presence of Ca in the ppt. has long been known, and compensates for incomplete pptn. of P_2O_5. The method is considered to be trustworthy. R. T.

Salt error in determinations of phosphate in sea-water. L. H. N. COOPER (J. Marine Biol. Assoc., 1938, 23, 171—178).—The yellow tint that may occur during PO_4 determinations in sea-H_2O when $SnCl_2$ solution is added to sea-H_2O containing acid molybdate reagent is attributed to hydrolytic products of complex Mo halides. When 1 ml. of the usual acid molybdate reagent per 100 ml. of sea-H_2O is used, the addition of $Cu^{\cdot\cdot}$ reduces the development of the blue colour in sea-H_2O and in distilled H_2O standards to the same extent (cf. A., 1936, 1478). The correction factor 1·12 applies equally to comparisons by daylight in Hehner cylinders and to photometric determinations with a red filter. When 2 ml. of reagent per 100 ml. of sample are used, the factor depends on the method of comparison; in Hehner cylinders in daylight it is 1·35, but with a photometer and red filter it is 1·19. L. S. T.

Separation of phosphoric from arsenic acid with triethanolamine molybdate. A. TETTAMANZI (Atti R. Accad. Sci. Torino, Cl. Sci. fis. mat. nat., 1935, 71, I, 125—130; Chem. Zentr., 1937, i, 938).—The complete pptn. of H_3PO_4 and its separation from H_3AsO_4 is effected in the cold by using excess of $N(C_2H_4\cdot OH)_3$ in a slight excess of HNO_3 and preferably in presence of citric acid. A. H. C.

Potentiometric titration of superphosphate solutions.—See B., 1939, 35.

Colorimetric determination of phosphate in boiler water.—See B., 1939, 1.

Polarographic determination of arsenic and iron in contact sulphuric acid.—See B., 1939, 34.

Determination of arsenic in minerals etc.—See B., 1939, 55.

Rapid determination of silica and iron in agglomerate. B. A. SOSNOVSKI (Zavod. Lab., 1938, 7, 867—868).—0·5 g. of agglomerate and 1·5 g. of Eschka's mixture are heated at 1000° for 10 min., and the product is treated with 1 : 1 HCl. SiO_2 is determined by the usual method, and Fe by $K_2Cr_2O_7$ titration, without previous pptn. with aq. NH_3.

R. T.

Determination of silicon in magnesium.—See B., 1939, 54.

Determination of silicon in ferrosilicon.—See B., 1939, 51.

Rapid determination of silicic acid in kaolin clay.—See B., 1939, 42.

Accurate determination of carbonate in fluorides.—See B., 1939, 35.

Detection and determination of carbon monoxide.—See B., 1939, 36.

Determination of carbon disulphide and oxysulphide in gases.—See B., 1939, 36.

Salt analysis of cyanide melt.—See B., 1939, 35.

Micro-volumetric determination of potassium. O. G. SCHEINTZIS (J. Appl. Chem. Russ., 1938, **11**, 1012—1016).—Excess of $2 \cdot 5\%$ $Mg\{N[C_6H_2(NO_2)_3]_2\}_2$ is added to the solution, containing $0 \cdot 1$—10 mg. K, and the ppt. of K salt is collected, washed (saturated aq. $MgSO_4$ at $0°$) on the centrifuge, and dissolved in 50% $COMe_2$. The solution is added to standard $Ti_2(SO_4)_3$, excess of which is titrated after 5 min. with standard Fe alum.   R. T.

Determination of small amounts of potassium. Simpler and more rapid variation of the sodium cobaltinitrite method. D. S. BROWN, R. R. ROBINSON, and G. M. BROWNING (Ind. Eng. Chem. [Anal.], 1938, **10**, 652—654).—In the procedure described the K is pptd. in a relatively short time at room temp., centrifuged, washed only once, and titrated with $Ce(SO_4)_2$ using o-phenanthroline–$Fe^{..}$ as indicator. The method is suitable for $0 \cdot 2$ to $1 \cdot 0$ mg. K, especially in plant material and soil extracts. The error is, in general, $\not> 2\%$. Examination of the effect of temp. on the recovery of K shows that the variations are significant only when amounts of $\sim 0 \cdot 2$ mg. of K are involved. In this case, a temp. of $20°$ is recommended. The effect of Co on the vol. of $Ce(SO_4)_2$ required for the titration of the cobaltinitrite ppt. is also discussed.   L. S. T.

Sodium salt of hexanitrodiphenylamine as a microchemical reagent. M. J. SCHAPIRO (Zavod. Lab., 1938, **7**, 790—792).—$NaN[C_6H_2(NO_2)_3]_2$ gives characteristic crystals with K, Rb, Cs, Tl, Pb, and Hg^{II}; those given by Be and Zr salts are of free $NH[C_6H_2(NO_2)_3]_2$, and are pptd. by any acid solution.   R. T.

[Analysis of sodium hydrogen carbonate.]—See B., 1939, 101.

Application of stannic bromide to the determination of cæsium in presence of rubidium and potassium. R. V. FELDMAN (J. Appl. Chem. Russ., 1938, **11**, 1017—1023).—The solution is repeatedly evaporated to dryness with HBr, the bromides are dissolved in 2 ml. of H_2O and 7 ml. of conc. HBr, and $0 \cdot 5$ ml. of 20% $SnBr_4$ in EtOH is added to the boiling solution. The ppt. of Cs_2SnBr_6 is collected after 3 hr., washed with HBr and then EtOH, dried, and weighed. Rb and K do not interfere, unless present in very large amount.   R. T.

Angular constants of micro-crystalline profiles and silhouettes in the conclusive identification of substances. Octagons of a cinchophen hydrochloride hydrate and of silver dichromate. A. C. SHEAD (Ind. Eng. Chem. [Anal.], 1938, **10**, 662—665; cf. A., 1937, I, 45, 630).—The use of measurements of the angles of the octagon and their sequence in identifying the flat, platy crystals encountered in microchemical practice is discussed.   L. S. T.

Analysis of bone ash.—See B., 1939, 101.

Fluorescence analysis of glass in ultra-violet light.—See B., 1939, 67.

Iodate method of determination of barium and lead in salts. K. A. BOGDANOV (Zavod. Lab., 1938, **7**, 793—794).—30 ml. of saturated aq. KIO_3 are added to the boiling solution, containing about $0 \cdot 2$ g. of Ba or Pb salt, and the solution is filtered at $10°$. The washed ppt. is suspended in H_2O, 30—40 ml. of 10% KI and 10 ml. of 25% H_2SO_4 are added, and the I liberated is titrated with $Na_2S_2O_3$.   R. T.

Micro-determination of magnesium in pure solutions and in blood-serum. M. DELAVILLE and M. OLIVE (Ann. Chim. Analyt., 1938, [iii], **20**, 286—287).—The solution containing $Mg^{..}$ is neutralised (neutral-red), 1 c.c. of N-NaOH and 1 c.c. of a saturated solution of Na tartrate are added and the Mg is pptd. with an EtOH solution of 8-hydroxyquinoline. After heating, the solution is centrifuged, and the ppt. is washed with H_2O until no longer alkaline, dissolved in $0 \cdot 025$N-HCl, and the solution titrated hot with $0 \cdot 01$N-NaOH (neutral-red). The method can be applied to blood-serum after ashing, treatment with HCl, $H_2C_2O_4$, $(NH_4)_2C_2O_4$, expulsion of NH_4 salts, and dissolution in HCl according to the procedure described.   L. S. T.

Photometric determination of magnesium in aluminium and its alloys.—See B., 1939, 54.

Reaction of zinc. K. KOMÁREK (Coll. Czech. Chem. Comm., 1938, **10**, 453—458).—The reaction $2Fe(CN)_6''' + 2I' = 2Fe(CN)_6'''' + I_2$ is used to detect Zn ($\not> 0 \cdot 001$M.). Freshly prepared $0 \cdot 01$N-$K_3Fe(CN)_6$ solution buffered at p_H 5—6 with NH_4OAc, mixed with KI and starch mucilage, liberates I (as shown by blue colour) only on the addition of an equal vol. of $Zn^{..}$ solution. With very dil. solutions the colour develops after 2 min. The separation of $Zn^{..}$ from interfering substances, $Fe^{..}$, $Co^{..}$, Ni, Mn, is necessary before testing, a procedure being described.   F. H.

Polarographic determination of cadmium and copper in zinc sulphate solutions.—See B., 1939, 35.

Tyndall- and fluorescence-photometric measurements for the determination of small quantities of material. E. HERZFELD (Z. anal. Chem., 1938, **115**, 127—135).—An arrangement for measuring the Tyndall effect of substances, kept in a dispersed condition by means of 50% glycerol, and matching the colour of the Tyndall cone or of the fluorescence of the dispersion is described, and applied as a rapid method for determining small amounts of cations, anions, etc. Limiting sensitivities and Tyndall cone colours given by various reagents are recorded for $Pb^{..}$, $Ag^{.}$, $Hg^{..}$, $Cu^{..}$, $Pd^{..}$, $Au^{...}$, $Al^{...}$, $Fe^{...}$, $Co^{..}$, $Ni^{..}$, $Pr^{...}$, $Ce^{....}$, $Sm^{...}$, $Nd^{...}$, $La^{...}$, Cl′, Br′, I′, F′, SO_4'', Cr_2O_7'', AsO_4''', and BO_2'.   L. S. T.

Stability of dithizone solutions. P. A. CLIFFORD (J. Assoc. Off. Agric. Chem., 1938, **21**, 695—703).—The stability of dithizone in $CHCl_3$ solution is increased by purification of the $CHCl_3$ by Biddle's method (cf. Hubbard, A., 1937, III, 504). Solutions in CCl_4 will keep almost indefinitely in the cold and dark under $0 \cdot 1$M-aq. SO_2.   E. C. S.

Rapid [determination of] traces of metals by the dropping mercury electrode. R. H. MÜLLER

and J. F. Petras (J. Amer. Chem. Soc., 1938, 60, 2990—2993).—A simple increment method is proposed, in which the change in current is noted for two applied potentials approx. equidistant from the characteristic " Halbwellen " potential. The current increments are a linear function of the concn. of the given ion. Interference due to the presence of other ions is ≯ with conventional polarographic methods. The procedure is illustrated by application to Pb¨, Cd¨, and Zn¨, and their pairs in neutral and alkaline solutions.   E. S. H.

Analysis of lead.—See B., 1939, 53.

Polarographic determination of lead and cadmium in zinc.—See B., 1939, 52.

Hypophalogenites in volumetric analysis. III. Hypochlorite and hypobromite. O. Tomíček and P. Filipovič (Coll. Czech. Chem. Comm., 1938, 10, 415—429; cf. A., 1938, I, 581).—Determination of Tl·, SeO_3'', TeO_3'', $NH_4·$, and N_2H_4 is possible using $Ca(OCl)_2$ and KBr, the end-point being determined potentiometrically. Tl^I salts give results 1% low and for large amounts of TeO_3'', NaOCl is preferable to $Ca(OCl)_2$. With large amounts of $NH_4·$, excess of $Ca(OCl)_2$ is used and the excess determined with AsO_3'''. $MgNH_4PO_4$ cannot be oxidised quantitatively. Quinol is determined accurately when CO_2 is bubbled through the solution. $CO(NH_2)_2$ gives results 2% low, excess of $Ca(OCl)_2$ being added in presence of $NaHCO_3$ and the excess determined by AsO_3'''. High results in titrations with NaOBr are considered to be due to contained BrO_3'.   F. H.

Can radioactive isotopes of thallium with a long life-period be used as indicators? V. Majer (Chem. Listy, 1938, 32, 436—438).—Thermic neutrons from a Ra + Be source were allowed to act on Tl_2O, with the object of obtaining ^{204}Tl (half life-period 97 min.), to be used in place of Th-C" as an indicator of Tl. The product obtained exhibited feeble activity, and contained chiefly ^{206}Tl. Using a Geiger–Nuttall counter, the radioactivity of Th-C" can be detected during 30 min., which suffices for most analytical purposes.   R. T.

Anthranilic acid as a reagent for the micro-chemical detection of certain metals. O. G. Scheintzis (J. Gen. Chem. Russ., 1938, 8, 596—601). —0·5% aq. anthranilic acid gives characteristic cryst. ppts., serving for detection of ≮ the following amounts of cations : Cu 0·013 (Co^{II}, Fe^{III}, and Ce^{IV} interfere), Hg^I 0·06, Pd^{II} 0·015, Zn 0·05, and Ag 0·24 µg.   R. T.

Determination of copper, zinc, and cobalt (with nickel) in soil extracts.—See B., 1939, 84.

Analysis of Schweinfurt-green.—See B., 1939, 75.

Microcrystalline reaction for the detection of mercury. R. Lobo (An. Farm. Bioquim., 1936, 7, 1—2; Chem. Zentr., 1937, i, 941).—5 µg. of Hg may be detected by the formation of a yellow cryst. ppt. with sozoiodol. Only Tb behaves similarly, but the colour is much lighter.   A. H. C.

Potentiometric determination of mercury with vanadium sulphate in alkaline solution. C. Del

Fresno and E. de Lafuente (Gazzetta, 1938, 68, 619—625).—The theory of the oxidation–reduction of V salts is discussed. The reaction between K_2HgI_4 and $VOSO_4$ can be followed potentiometrically, and in strongly alkaline solution gives an accurate method of determining Hg.   O. J. W.

Specific test for mercury, on aluminium. A. Langer (Chem. Listy, 1938, 32, 438—440).—A drop of solution, a few crystals of Na_2SO_4, and a drop of saturated aq. quinoline are placed in a hollow in an Al block, a Pt anode is inserted, and a current is passed for 15 min. The Al is washed, wiped, and a solution of alizarin in AcOH is placed in the hollow, which is again washed after 3 min.; red spots are to be seen on the Al when the solution under test contains ≮0·001 µg. Hg.   R. T.

Nephelometric method for determining small quantities of mercury. A. A. Saukov (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 373—375). —The method uses the turbidity produced in slightly acid Hg^{II} solutions by Reinecke's salt, $NH_4[Cr(NH_3)_2(CNS)_4]$, and is applicable to solutions containing 0·2 to 10 µg. per c.c.   F. J. G.

Mercurous salts and their amido-compounds. III. T. F. Egidius (Z. anorg. Chem., 1938, 240, 97—112).—A rapid method for determining Hg, Cl, and NH_3, in presence of one another, has been worked out and applied, together with X-ray photography, to the investigation of the black ppt. formed from aq. NH_3 and Hg_2Cl_2. There are three compounds, $Hg_4Cl_4(NH_3)_4$ (I), $Hg_4Cl_2(NH_2)_2(H_2O)_x$ (II), and $Hg_4ClN(H_2O)_x$ (III), all of which are olive-green to black ppts. (I) is obtained by the action of 2n-NH_3 in presence of NH_4Cl on Hg_2Cl_2, (II) results when n-NH_3 and no NH_4Cl is used, and (III) is formed by the action of H_2O or dil. NH_3 on (I) or (II). They are not obtained absolutely pure as a slight disproportion-ation to Hg and Hg^{II} always occurs. (I) can be continuously transformed into (II) or (III) by treatment with H_2O or dil. NH_3, and the reverse transformation is brought about by NH_3 in presence of NH_4Cl.   F. J. G.

Micro-determination of mercury.—See A., 1939, III, 188.

Vanadous sulphate as a reducing agent. III. Determination of cerium. P. C. Banerjee (J. Indian Chem. Soc., 1938, 15, 475—478).—Ce salts are either reduced by excess of VSO_4 and the excess titrated back with $KMnO_4$, or oxidised by means of $(NH_4)_2S_2O_8$ to $Ce(SO_4)_2$ and the latter titrated directly with VSO_4 using NHPh$_2$ as an internal indicator. Oxidising agents must be absent.   C. R. H.

Analytical applications of fluorescent solutions of rare-earth salts. A. Zaidel, J. Larionov, and A. N. Filippov (J. Gen. Chem. Russ., 1938, 8, 943—948).—Fluorescence spectrum measurements allow the detection of Tb ≮0·01, Ce 0·1, and Eu 100 p.p.m.   R. T.

Determination of aluminium in silicochrome. —See B., 1939, 53.

Quantitative spectral analysis of ores and minerals [for indium, thallium, and germanium].—See B., 1939, 55.

Determination of manganese in alloys of high manganese content.—See B., 1939, 53.

Determination of rhenium in pyrolusite. L. C. HURD and C. F. HISKEY (Ind. Eng. Chem. [Anal.], 1938, 10, 623—626).—The sample is dissolved in HCl, filtered, and the $Fe^{...}$ and $Mn^{...}$ are reduced by the addition of $SnCl_2$. Aq. KCNS and $SnCl_2$ are added and the Mo and Re oxythiocyanates extracted with Et_2O. After evaporation of the Et_2O in a special way H_2O_2 is added to oxidise the Re. The solution is diluted with conc. H_2SO_4 and distilled at 270—290° in a current of steam and CO_2. Re in the distillate is determined colorimetrically by means of KCNS and $SnCl_2$. Test data are recorded. Examination by this method of 80 samples of pyrolusite from many localities showed the absence of Re in the majority; three samples of low-grade Montana ore contained 0·1 p.p.m., and one contained 0·2 p.p.m. Four of five Mexican samples contained 0·1 p.p.m. Analysis of Mn samples by alternate oxidation and reduction, followed by sublimation, is of no val., since in presence of a large excess of base only a fraction of the Re is thus removed. After treatment with $SnCl_2$ and CNS', H_2PtCl_6 yields an Et_2O extract having a colour similar to that given by Re. In 4N-HCl, the colour duo to Re oxythiocyanate is stable but that due to Mo is soon bleached. In $9·3N-H_2SO_4 + 4·9N-HCl$ the colour due to Mo can be inhibited without greatly affecting the Re reaction. The presence of Re in pyrolusite used for Leclanché cells is objectionable.   L. S. T.

Determination of iron in presence of titanium using zinc reduction. E. TRUOG and R. W. PEARSON (Ind. Eng. Chem. [Anal.], 1938, 10, 631—632; cf. A., 1935, 720).—After passing through the Jones reductor, the Ti can be selectively oxidised by the addition of 50 c.c. of aërated distilled H_2O and stirring for ≮3 min. after the disappearance of the violet colour. When there is no violet colour after reduction (<0·1 mg. of Ti) vigorous stirring for 3 min. is sufficient. $FeSO_4$ solutions containing ∼25 mg. of Fe and 5 vol.-% of H_2SO_4 are stable for ≮30 min. after aëration by (i) stirring, (ii) addition of aërated H_2O and stirring, (iii) aspiration of air, or (iv) shaking. Of these methods, (ii) effects the quickest oxidation of the Ti.   L. S. T.

Titration of ferrous iron with dichromate in presence of brucine indicator. E. A. ALEXEEVA and N. N. ANDRONIKOVA (J. Appl. Chem. Russ., 1938, 11, 1024—1027).—The end-point of titration of Fe^{II} with $K_2Cr_2O_7$ is indefinite in presence of HCl when $NHPh_2$ indicator is used; the use of brucine is recommended.   R. T.

Volumetric determination of ferrocyanide and arsenious acid in presence of each other. R. LANG (Z. anal. Chem., 1938, 115, 103—104).—In agreement with Böhm, a small amount of $Fe(CN)_6'''$ poisons the Os catalyst and prevents the titration of As_2O_3 with $Ce^{....}$ after the determination of any $Fe(CN)_6''''$ with $Ce(SO_4)_2$. Titration of the As_2O_3 by $KMnO_4$ using the I catalyst (A., 1926, 581) is satisfactory, however, even in presence of $Cr^{...}$. The solution of $Fe(CN)_6'''' + AsO_3'''$ in ∼N-H_2SO_4 is first titrated with $0·1N-Ce(SO_4)_2$ using ferroin as indicator (brown → light green), then 1—2 g. of NaCl and 5 drops of $0·0025M-KIO_3$ are added, and the AsO_3''' is titrated with $0·1N-KMnO_4$ (brown → light green).   L. S. T.

Determination of small quantities of iron in mercury.—See B., 1939, 53.

Influence of molybdenum on the analysis of steel by Schulte's method.—See B., 1939, 51.

Polarographic determination of iron in ores and slags.—See B., 1939, 51.

Photometric titration of cobalt, iron, and copper in nickel sulphate solution. Photometric titration of cobalt. T. SOMIYA and Y. YASUDA (J. Soc. Chem. Ind. Japan, 1938, 41, 314—315B).—Cu in 0·4N-aq. $NiSO_4$ was pptd. on Zn and solid Zn amalgam which were collected and dissolved in HNO_3, and the solution was treated with Br–H_2O; after addition of a slight excess of aq. NH_3 and an excess of AcOH, the solution was diluted, KI was added, and the I titrated photoelectrically with $0·01N-Na_2S_2O_3$. After removal of Zn from the solution H_2SO_4 was added and Fe determined photoelectrically with $0·01N-KMnO_4$. For the determination of Co, 2 g. of $Na_4P_2O_7$ were added to 10 g. of $NiSO_4$ in 50 c.c. of H_2O, air was replaced by N_2, 5 c.c. of conc. NH_3 and 10 g. of $(NH_4)_2CO_3$ were added, the solution was diluted to 100 c.c. and photoelectrically titrated with $0·1N-H_2O_2$; Mn interferes.   W. R. A.

Determination of small amounts of nickel, cobalt, and copper in ores.—See B., 1939, 56.

Determination of cobalt in presence of nickel. D. C. SEN (J. Indian Chem. Soc., 1938, 15, 473—474).—To 200 c.c. of the boiling Co solution (0·005—0·02% Co) are added 50 c.c. of NaOAc (10%) and sufficient of a 1% solution of oximinothiocamphor in EtOH to ppt. the Co. The ppt. of $C_{30}H_{42}O_3N_3S_3Co$ is washed with hot H_2O, 0·2N-NaOH, 2N-HCl, and hot H_2O and either dried at 105—110° or ignited to $CoSO_4$. In presence of Ni 30 c.c. of 2N-HCl are added after the pptn., and filtering is delayed for 30—40 min.   C. R. H.

Rapid colorimetric determination of nickel in slags.—See B., 1939, 52.

Determination of nickel in aluminium alloys by spectral analysis.—See B., 1939, 52.

Determination of chromium in chromiferous iron ores and ferrochromium.—See B., 1939, 51.

Determination of chromium and silicon in a single sample of ferrochromium.—See B., 1939, 51.

Colorimetric determination of molybdenum, using pyrogallol. R. I. ALEXEEV (Zavod. Lab., 1938, 7, 863—865).—The neutral solution is diluted to a concn. of 5—10 mg. Mo per 100 ml. To 10 ml. are added 10 ml. of 1% pyrogallol in 2% AcOH and 10 ml. of 0·2N-NaOAc, and the coloration developing is compared with those given by standard solutions.   R. T.

Standard coloured solutions for colorimetric determination of tungsten and molybdenum. F. A. FERIANTSCHITSCH and D. N. JORDANSKI (Zavod. Lab., 1938, **7**, 866—867).—The coloration obtained in the determination of W by the Feigl–Krumholz method (A., 1932, 1224) is imitated by a solution of $[Co(NH_3)_5,H_2O]Cl_3$ (I) in dil. aq. NH_3. Those obtained in King's method for Mo are imitated by mixing (I), Me-orange, and dil. aq. NH_3 in various proportions. The standards are unsuitable for use with a Duboscq colorimeter.   R. T.

Determination of tungsten by vanillylidene-benzidine. Determination of molybdenum by vanillylidenebenzidine. V. HOVORKA (Coll. Czech. Chem. Comm., 1938, **10**, 518—525, 526—533).—Vanillylidenebenzidine (3% solution in 50% AcOH) ppts. W quantitatively from boiling solutions of $Na_2WO_4,2H_2O$. The ppt., being of variable composition, is collected after $\frac{1}{4}$ hr., washed with dil. reagent, calcined, and weighed as WO_3. Quant. pptn. in the cold is obtained only in the presence of $0\cdot1N\text{-}H_2SO_4$. The reagent is superior to benzidine as precipitant, giving a less sol. reddish-brown ppt. and is superior to piperonylidene-, o-methylbenzylidene-, and p-dimethylaminobenzylidene-benzidine, being stable in the very dil. AcOH solutions used for washing the pptd. tungstate. The reagent also ppts. Mo quantitatively from boiling solutions of $Na_2MoO_4,2H_2O$ provided the mixture is boiled only for $\frac{1}{2}$ min. and the ppt. collected after 5 hr. The ppt. is washed with dil. reagent, dried, calcined in a furnace at $\gt 400°$, and weighed as MoO_3.   F. H.

Catalytic colour reaction for tungsten. E. B. SANDELL (Ind. Eng. Chem. [Anal.], 1938, **10**, 667—668).—W catalyses the reaction between $TiCl_3$ and malachite-green (I) in dil. acid solution. W^{VI} is rapidly reduced by $TiCl_3$ to lower valency states which quickly reduce (I) to the leuco-form. Sn, As, Sb, Bi, Cu, Au, Pt, Pb, Tl, Fe, V, U, and Nb do not catalyse this reaction, but this method for the detection of W fails when appreciable amounts of Fe^{III}, U^{VI}, and V^{V} or cations which are reduced to metal or form insol. chlorides are present. Mo catalyses the reaction, but its effect is so much $<$ that of W that it seldom interferes. Alkali chlorides and the chlorides of metals not reduced by $TiCl_3$ only decrease the reaction time of the blanks. Alkali sulphates and $MgSO_4$, but not $ZnSO_4$, markedly increase the reaction velocity between (I) and $Ti^{...}$ in absence of W, and decrease the catalytic effect of W. NO_3' must be absent, whilst F' forms a complex with W and inhibits the catalysis. Tartaric acid increases the reaction velocity in absence of W, especially when the acidity is low. PO_4''' also accelerates the reaction in $0\cdot1N\text{-}HCl$ in both absence and presence of W. For use as a drop reaction, 0·05 ml. of the neutral or $0\cdot1N\text{-}HCl$ test solution is treated with 0·01 ml. of 1% $TiCl_3$ and 0·01 ml. of 0·005% aq. (I), always in this order. The test solution is decolorised more or less rapidly depending on [W]. The blank remains green for $\sim$4 min.   L. S. T.

Determination of small amounts of tungsten in steel.—See B., 1939, 51.

Polarographic studies with dropping mercury cathode. LXXV. Determination of uranium and other heavy metals in [presence of] excess of iron. R. STRUBL (Coll. Czech. Chem. Comm., 1938, **10**, 466—474).—U may be determined polarographically in presence of 1000-fold excess of $Fe^{...}$ using NH_2OH in acid solution for reduction of $Fe^{...}$ to $Fe^{..}$. The method is applicable to the determination of occluded U in $Fe(OH)_3$ pptd. from radioactive samples, the U content being measured by the height of the first U " wave " occurring on the current–voltage curve at $-0\cdot23$ v. (from $N\text{-}Hg_2Cl_2$ zero) of the dropping Hg cathode, a second " wave " occurring at $-1\cdot05$ v. Well defined " waves " are also obtained due to U in the $(NH_4)_2CO_3$ complex of $UO_2(OAc)_2$ in excess of $K_4Fe(CN)_6$. NH_2OH in acid solution is a suitable reagent for the polarographic determination of Cu, Bi, Sb, Sn, Pb, Tl, Cd, In, Cr, Ti, and Zn in presence of excess of Fe.   F. H.

Determination of uranium in steels.—See B., 1939, 51.

p-Hydroxyphenylarsinic acid as a reagent for titanium and zirconium. C. T. SIMPSON and G. C. CHANDLEE (Ind. Eng. Chem. [Anal.], 1938, **10**, 642—643).—$p\text{-}OH\cdot C_6H_4\cdot AsO_3H_2$ affords in one pptn. satisfactory separations of Ti and Zr from Fe (in presence of CNS') and many ions in dil. mineral acid solutions. Sn is also pptd. quantitatively in mineral acid solutions ($<0\cdot5N$). Data showing the separation of Ti from $Fe + PO_4$, from Al, Zn, Co, Ni, Be, Cr, and Mn, from Ca and Mg, from Cr_2O_7'', MnO_4', $UO_2^{..}$, and $V_2O_2^{....}$, from MoO_4'', from $Tl^{...}$ and $Ce^{...}$, from $Th^{....}$, from Cr–V steel, Fe ore, burnt refractory, and plastic clay are given. In all cases the Ti is weighed as TiO_2 after ignition. Zr and Ti are separated from each other by addition of H_2O_2 before pptn. PO_4''' in moderate amount, $Ce^{....}$, and Sn interfere with the determination of Ti and Zr.   L. S. T.

Polarographic studies with dropping mercury electrode. VIII. Titanometry. R. STRUBL (Coll. Czech. Chem. Comm., 1938, **10**, 475—492).—Solutions of $TiCl_3$ and $TiCl_4$ in HCl examined polarographically by anodic and cathodic current–voltage curves give a " wave " at $E_{\frac{1}{2}} = -0\cdot18$ v. (from $N\text{-}Hg_2Cl_2$ zero) when the dropping Hg electrode is made the anode, the height measuring concn. of $TiCl_3$, and a " wave " at $E_{\frac{1}{2}} = -0\cdot98$ v., the height measuring concn. of $TiCl_4$, when the electrode is made the cathode. The oxidation–reduction becomes thermodynamically reversible and the " waves " coincident at $E_{\frac{1}{2}} = -0\cdot48$ v. when excess of tartaric (I) or citric acid (II) is added to the solution. Polarographic titration of Fe^{III} or Cr^{III} salts or MnO_4' is possible by $TiCl_3$ in presence of (I) or (II), the end-point being obtained graphically. Two readings only of the galvanometer deflexion are necessary, one before and one after the end-point. Greater precision than in potentiometric titration is claimed.   F. H.

Determination of germanium in minerals and solutions. W. C. AITKENHEAD and A. R. MIDDLETON (Ind. Eng. Chem. [Anal.], 1938, **10**, 633—635).—Ge is extracted from minerals by heating with HF, HNO_3, and H_2SO_4, and subsequent treatment with

NaOH + Na_2S, HCl, and Cu. Solutions are treated directly with HCl and Cu to remove As and Sb. The solutions obtained in either case are distilled with HCl and the Ge is collected in H_2O. Amounts of Ge >2 or 3 mg. are determined gravimetrically by careful evaporation of the distillate with HF, H_2SO_4, and $HClO_4$, which gives GeO_2 directly without a preliminary pptn. by H_2S. Amounts of Ge $\not> 0.1$ mg. are determined by a modified Marsh test using Zn + HCl under closely-controlled conditions. This is accurate for 0.001—0.1 mg. of Ge. Losses of Ge through volatilisation of the fluoride and through the formation of the acid-insol. form of GeO_2 are avoided in the procedures described. The prep. of reagent Cu for use in these methods and of electrolytic Zn of the high purity essential for the modified Marsh test is detailed.   L. S. T.

Volumetric determination of vanadium. B. S. EVANS (Analyst, 1938, **63**, 870—873).—V^V is reduced to V^{IV} with $K_4Fe(CN)_6$, $VFe(CN)_6$ being pptd., and the $K_3Fe(CN)_6$ formed reacts with KI in presence of $Zn^{..}$ liberating I, which is titrated. All operations are carried out in absence of O_2. A blank titration of the $K_4Fe(CN)_6$ is necessary. The method is accurate for 1—10 mg. of V.   E. C. S.

Spectral analysis of alloy steels for vanadium and aluminium.—See B., 1939, 51.

Spectral analysis of steels for vanadium and molybdenum.—See B., 1939, 51.

Rapid electrolytic determination of antimony. S. L. JOVANOVITCH (Z. anal. Chem., 1938, **114**, 415—425).—The electrolytic method described gives for amounts of Sb of ~1 g. an accuracy of −0.1% and for amounts of Sb of ~0.2 g., one of −0.02%. Electrolysis is effected in H_2SO_4 solution, in presence of pptd. basic Sb sulphate, under controlled conditions and the Sb finally pptd. is weighed. The presence of tartrate does not affect the accuracy of the results or the duration of the electrolysis. The bromatometric titration of Sb gives low results (~0.2%) (cf. A., 1923, ii, 253). Contrary to the findings of Zintl and Wattenberg (*loc. cit.*), Sb^{III} is not readily oxidised when exposed to air at 95°. The electrolytic method is applicable to Sb ores.   L. S. T.

Detection of small amounts of antimony in tinfoil.—See B., 1939, 53.

Titration with alkaline permanganate solution. III. Oxidimetric determination of bismuth. H. STAMM and M. GOEHRING (Z. anal. Chem., 1938, **115**, 1—8; cf. A., 1935, 55).—The Bi (~1 mg. per 5 c.c.) is pptd. as $Bi[Cr(CNS)_6]$ by Mahr's method (A., 1932, 1224), and the ppt. decomposed by alternate treatments with NaOH and H_2SO_4. The filtrate containing the CNS′ is made alkaline with NaOH and, after removal of Cr′′′ and Bi′′′, is added to an alkaline solution of $KMnO_4$, when the reaction CNS′ + 4O + OH′ = $SO_4″$ + HCNO takes place on warming. Aq. $H_2C_2O_4$ and $MnSO_4$ are then added, and the titration is completed with standardised 0.02M-$KMnO_4$. Details of procedure are given. The method is suitable for amounts of Bi $\not<$1 mg., and has the advantage that Bi is equiv. to 48 g.-equivs. of $KMnO_4$.   L. S. T.

Sensitive reactions for tantalum and niobium. M. J. SCHAPIRO (J. Appl. Chem. Russ., 1938, **11**, 1028—1032).—The colour of Rhodamine-B changes from red to violet in presence of $TaF_7″$ ($\not<$2 μg.); Mo, W, Hg, Au, Sb, and Fe interfere, but not Ti or Nb. Fe dipyridyl yields characteristic rectangular prisms with $TaF_7″$ ($\not<$2 μg. Ta); Nb, Ti, and Si fluoride salts do not interfere, whilst W and Mo complex fluorides yield ppts. of different cryst. form. $TaF_7″$ and $TaO_3′$ ($\not<$1 μg. Ta) give an amorphous grey-blue ppt. with aq. methylene-blue; Ti and Nb do not interfere, whilst W, Mo, V, Sb, Sn, and Al yield violet-blue ppts. when present in high concns. Brilliant-green gives a green ppt. with $TaF_7″$ ($\not<$0.4 μg. Ta); Ti, Mo, and Sn interfere, but not $TaO_3′$, $NbO_3′$, or $NbOF_5″$. Gentian-violet gives a violet ppt. with $TaF_7″$ ($\not<$0.4 μg. Ta); W, V, $TaO_3′$, $NbO_3′$, and $SnCl_2$ interfere, but not Fe, Mo, or $NbOF_5″$. $NbO_3′$ and $NbOF_5″$ ($\not<$1 μg. Nb) give a yellow coloration with KCNS and $SnCl_2$ in HCl; Ti, Mo, W, and V, but not Ta, interfere. Nb salts ($\not<$0.4 μg. Nb) give a yellow coloration with pyrocatechol in aq. NaOAc; Ti and Fe^{III}, but not Ta, interfere. Nb and Ta are powerful catalysts of the reaction $4H_2O_2 + S_2O_3″ \rightarrow 2SO_4″ + 2H + 3H_2O$, greatly surpassing Mo in this respect; this reaction serves for detection of 0.2 μg. Nb, or 0.4 μg. Ta, in 4 ml. of solution.   R. T.

Reactions of resorcinol with niobium and tantalum salts. F. M. SCHEMJAKIN and V. A. PILITSCHENKO (J. Gen. Chem. Russ., 1938, **8**, 824—828).—K_2TaF_7 and K_2NbF_7 do not give colour reactions with resorcinol (I) in presence of aq. NH_3 or KOH. Many rare-earth elements (Ce^{III}, Th, Pr, La, Zr, U) give green solutions or ppts. with (I) in aq. NH_3, but not KOH.   R. T.

New reactions for detection of niobium and tantalum. O. E. ZVJAGINTZEV and Z. G. NAMORADZE (J. Gen. Chem. Russ., 1938, **8**, 829).—The reaction with resorcinol (Platonov *et al.*, A., 1937, I, 265) is not given by pure Nb salts, and cannot serve for detection of Nb or Ta.   R. T.

Reductometric determination of gold with arsenious acid. L. SZEBELLÉDY and B. VIEZIÁN (Österr. Chem.-Ztg., 1938, **41**, 431—435).—1—2 c.c. of the approx. 0.1N-Au′′′ solution in a 25 c.c. flask are treated with 1 g. of NaBr and 1 c.c. of fuming HCl, the solution is made up to 5 c.c., and then 2 c.c. of 1% gelatin solution are added. The mixture is heated at 95° and titrated with 0.1N-As_2O_3 until the orange-yellow colour, due to $NaAuBr_4$, remains completely discharged after 15—20 sec. The effects of adding various salts have been investigated, but only with relatively high concns. is any interference observed.   J. W. S.

Colorimetric determination of platinum. V. G. KARPOV and G. S. SAVTSCHENKO (Ann. Sect. Platine, 1938, No. 15, 125—128).—The $SnCl_2$ method is applicable to amounts of 0.05—0.2 mg. of Pt in 50 c.c. of solution, and the KI method to 0.02—0.7 mg. of Pt.   R. T.

Colorimetric determination of small amounts of platinum in nitric acid and other products. N. A. FIGUROVSKI (Ann. Sect. Platine, 1938, No. 15,

129—135).—500 ml. of HNO_3 are evaporated to dryness, and the residue is ignited, and dissolved in aqua regia. The solution is evaporated down to a syrup, HCl is added, and evaporation is repeated. The final product is diluted and filtered, and the filtrate + washings are made up to 25 c.c. 10 c.c. of the solution are shaken with 10 c.c. each of 10% $SnCl_2$ and EtOAc, and the coloration of the EtOAc layer is compared with that given by standard H_2PtCl_6 solutions. The method serves for determination of $\not< 0.03$ mg. of Pt.   R. T.

Potentiometric titration of complex compounds with several oxidisable components. A. A. GRÜNBERG and D. J. RJABTSCHIKOV (Acta Physicochim. U.R.S.S., 1938, 8, 773—786; cf. A., 1937, I, 246).—Complex Pt^{II} compounds containing HC_2O_4' or C_2O_4'' groups were titrated potentiometrically with $KBrO_3$ in aq. HCl. At suitable temp., the titration curves show two breaks with $[Pt(NH_3)_2C_2O_4]$ (I) and $K_2[PtCl_2C_2O_4]$ (II), three with $[Pt(NH_3)_2(HC_2O_4)_2]$ (III) and $K_2[Pt(C_2O_4)_2]$ (IV), and four with $[Pt(NH_3)_4][Pt(C_2O_4)_2]$ (V). It is shown by chemical analysis that in (I) and (II) the Pt^{II} is first oxidised to Pt^{IV}, and afterwards the (C_2O_4). In (III) and (IV) the same order is followed, but the two (HC_2O_4) or (C_2O_4) groups are oxidised in separate stages. In (V) the two Pt atoms are first oxidised, then the two (C_2O_4) groups, all in separate stages. If the (C_2O_4) does not form part of the complex, as in $[Pt(NH_3)_4]C_2O_4$, only a single break corresponding with Pt + (C_2O_4) is obtained. The stepwise oxidation of the two HC_2O_4 or C_2O_4 groups is attributed to strengthening of the linkage of the group which is *trans* to the one first attacked owing to the asymmetry caused by substituting Cl for the latter.   F. L. U.

Determination of palladium by means of potassium iodide. F. E. BEAMISH and J. DALE (Ind. Eng. Chem. [Anal.], 1938, 10, 697—698).—Data showing the effect of varied conditions on the pptn. of Pd by aq. KI are recorded. Pd can be determined on the macro- and micro-scales by direct weighing as PdI_2. The pptd. PdI_2 can be boiled in presence of an acid concn. $\not>$ ~0·8N., and $\not<$10 times the calc. amount of KI may be added without danger of losing Pd. PdI_2 can be ignited to metal, reduced in H_2, and cooled in CO_2 with much less danger of loss than is the case with Pd dimethylglyoxime. Pd can be separated from Au by dissolution of the latter in excess of KI, but the results are generally high, and a re-pptn. is necessary. Pptn. of the iodides from $PtCl_4$ and Na_3RhCl_6 containing 1·2 wt.-% of HNO_3 by 1% aq. KI is incomplete. Similar solutions of $RuCl_4$ and $IrCl_4$ gave no ppt. on warming or boiling.   L. S. T.

Oven for determination of resistance of heated wire. A. S. ZAIMOVSKI and V. A. ERACHTIN (Zavod. Lab., 1938, 7, 879—880).   R. T.

Vacuum furnace for production of single crystals of metals and alloys. F. C. NIX (Rev. Sci. Instr., 1938, 9, 426—427).—A vac. furnace giving a pressure of 10^{-3}—10^{-4} mm. and a temp. of 1100° is described.   A. J. M.

M.p. outfit. J. WERNER (Ind. Eng. Chem. [Anal.], 1938, 10, 685).—Capillaries containing the substance are placed in contact with the thermometer bulb by introduction through a side arm fused at an angle slightly <45° on to the side of a 400-c.c. Pyrex beaker. Cottonseed oil, compounded with 1% of quinol, is used as the bath liquid, and uniform heating is obtained by supporting the beaker on an asbestos board.   L. S. T.

Measurement of refractive indices in the ultraviolet. A. GOLDET (Compt. rend., 1938, 207, 1040—1041).—Modifications in a total reflexion refractometer to render it suitable for measuring refractive indices in the ultra-violet are described.   W. R. A.

Determination and knowledge of molecular refraction. I. II. Determination of specific gravity at high temperatures. M. FURTER (Helv. Chim. Acta, 1938, 21, 1666—1680, 1680—1692).—I. Micro-methods of determining sp. gr. are reviewed. Micro-pyknometers of vol. 0·01—0·03 c.c. are described and the technique of their use is discussed. II. The application of the micro-pyknometric method to temp. $\not> 300°$ is described. Lupeol $(C_{30}H_{49}\cdot OH)$ has $d_4^{216\cdot0}$ 0·9569.   J. W. S.

Models to aid in visualising the optical properties of crystals. H. T. U. SMITH (Amer. Min., 1938, 23, 629—643).—Three-dimensional models are made from celluloid.   L. S. T.

Examination of solutions by diffraction of X-rays. J. A. PRINS (Chem. Weekblad, 1938, 35, 866—868).—A review.   S. C.

Apparatus for spectrographic analysis. E. E. CHANDLER (J. Chem. Educ., 1938, 15, 544—545).—An electrode for examining the spark spectra of solutions is described.   L. S. T.

Recording spectrograph for the far infra-red. H. M. RANDALL and F. A. FIRESTONE (Rev. Sci. Instr., 1938, 9, 404—413).—A photographic recording vac. spectrograph of high resolving power is described. The spectral range covered is 18—200 μ., and a single record may cover 9—100 μ. according to the grating and adjustment used.   A. J. M.

Illuminated wedge as an illumination accessory for high microscopic magnification. R. WEISE (Z. wiss. Mikrosk., 1936, 53, 201—204; Chem. Zentr., 1937, i, 1358).—Light is conc. on passing from the thick to the thin end of the wedge.   A. H. C.

Determination of time of exposure in photomicrography. M. WIELAND (Z. wiss. Mikrosk., 1936, 53, 183—192; Chem. Zentr., 1937, i, 1358).—The intensity of the incident light is measured photoelectrically and the exposure calc. allowing for the use of filters, polarised light, etc.   A. H. C.

Focussing [of X-rays] with the Seemann knife. V. DOLEJŠEK and M. ROZSÍVAL (Compt. rend., 1938, 207, 786—788).—High resolving power cannot be obtained with an X-ray spectrograph using a blunt Seemann knife and a curved NaCl or $CaSO_4$ crystal; the observed broadening of the lines is due to crystal imperfection. Elastic or plastic curvature does not affect the degree of imperfection. Excellent resolving power with high luminosity is obtained with the Seemann knife and a quartz crystal cut perpendicular to the electric axis.   A. J. E. W.

[Instrument for] fluorescence analysis.—See B., 1939, 76.

Photo-electric photometer for chemical analysis. B. N. SINGH and N. K. A. RAO (Plant Physiol., 1938, 13, 419—425).—Apparatus is described by means of which light absorption of a solution is measured within a narrowly-defined region of the spectrum. Accuracy of $\pm 2 \cdot 24\%$ is claimed.
A. G. P.

Time lag in gas-filled photo-electric cells. A. M. SKELLETT (Physical Rev., 1937, [ii], 51, 1026).—The data obtained can be explained by the hypothesis that the time lag is due to the transit time of the positive ions. L. S. T.

Integrator of radiant energy. L. QUEVRON (Compt. rend., 1938, 207, 902—903).—The quantity of energy received by a photo-cell or thermopile is measured by the rate of deflexion of a fluxmeter.
A. J. E. W.

Microchemical analyses using photo-cells. G. V. TROITZKI (J. Appl. Chem. Russ., 1938, 11, 1005—1011).—A photometer is adapted to small amounts of solutions by increasing the length of the cup, while diminishing its vol.; in this way, and by application of appropriate filters, amounts of $< 2 \times 10^{-9}$ g. of Fe are determined. The technique of determining carotene and chlorophyll in the same solution, using different filters, is described. R. T.

Portable electrode for p_H measurements. P. KONTIO (Suomen Kem., 1938, 11, A, 152—153).—A Hg_2Cl_2 electrode, in which mixing of the components is prevented, is described. M. H. M. A.

Automatic p_H controls. H. R. HALL (Canad. Chem., 1938, 22, 541—544).—Difficulties in mechanical construction encountered in applying glass electrode technique to industrial practice are discussed, and their solution is illustrated by a description of the development of the Coleman automatic p_H equipment. The robust, metal-clad electrode, the agar bridge, the automatic temp. correction, and the amplifier and power pack used in this equipment are described. L. S. T.

Laboratory apparatus for electrometric analysis. L. I. BELENKI (Zavod. Lab., 1938, 7, 834—841).—Apparatus is described. R. T.

Micro-conductivity cell of simple design. R. CRAIG and R. L. PATTON (Science, 1938, 88, 386). —The cell described has a resistance of about 2000 Ω when filled with 1% aq. NaCl. W. F. F.

Beryllium targets. H. R. CRANE (Rev. Sci. Instr., 1938, 9, 428).—Methods of cutting and soldering Be targets for use in the cyclotron are described.
A. J. M.

Repairing Nernst filaments. G. K. T. CONN (J. Sci. Instr., 1938, 15, 414).—Powdered ZrO_2 is ground with a few drops of H_2O to form a thick paste, and is applied to the filament ends which are separated by a distance approx. the diameter of the filament. After well working the paste into the broken ends, it is dried very gently over a fine gas flame. C. R. H.

Stable source of focussed ions. L. P. SMITH and G. W. SCOTT, jun. (Physical Rev., 1937, [ii], 51, 1025).—A modification of the source described previously (A., 1937, I, 583) produces a focussed beam of positive ions when a gas is bombarded by a focussed beam of electrons. L. S. T.

Discharge mechanism and characteristics of Geiger–Müller counter tubes. O. S. DUFFENDACK, M. M. SLAWSKY, and H. LIFSCHUTZ (Physical Rev., 1937, [ii], 51, 1027).—Experiments on counter tubes with W wire anodes and cathodes of Al, Cu, Ni, and W, in A, air, O_2, and H_2 at various pressures are discussed. L. S. T.

Use of ordinary counters for counting rapidly successive phenomena. B. KWAL and M. LESAGE (Compt. rend., 1938, 207, 779—780).—A rotating contact enables a known fraction of the electric impulses to be passed to one or more recording devices.
A. J. E. W.

[Conductivity] apparatus for rapid determination of water in wood.—See B., 1939, 46.

Molecular ray method for the separation of isotopes. O. STERN (Physical Rev., 1937, [ii], 51, 1028). L. S. T.

Burette top for precise control of the rate of outflow. E. P. WHITE (Ind. Eng. Chem. [Anal.], 1938, 10, 668). L. S. T.

Appliance for use with tapless burettes. V. I. SCHPAK (Zavod. Lab., 1938, 7, 880—881).—Screw clamps for squeezing rubber bulbs fitted to microburettes are described. R. T.

Simple combustion type of carbon monoxide estimation. J. B. FICKLEN (Science, 1938, 88, 411—412).—CO is converted into CO_2, which reacts with an alkaline-earth hydroxide, phenolphthalein being used as an indicator. The arrangement of the apparatus is described. W. F. F.

[Apparatus for] sampling lake deposits. B. M. JENKIN and C. H. MORTIMER (Nature, 1938, 142, 834—835). L. S. T.

Simplified construction of Hull–Davey charts. R. A. HARRINGTON (Rev. Sci. Instr., 1938, 9, 429—430).—The use of logarithmic scale for the axial ratio simplifies the construction of Hull–Davey charts for the hexagonal and tetragonal systems, and can be extended to orthorhombic systems by using a series of charts. A. J. M.

Measurement of sedimentation velocity in simple air-driven tops as ultracentrifuges. J. W. McBAIN and F. A. LEYDA (J. Amer. Chem. Soc., 1938, 60, 2998—3002).—Apparatus already noted (A., 1938, I, 375) is fully described. E. S. H.

Tubular vacuum-type centrifuge. J. W. BEAMS (Rev. Sci. Instr., 1938, 9, 413—416).—A method of spinning tubular rotors to high speeds in vac. is described. The material to be centrifuged, which may be gaseous or liquid, enters the rotor at the top at a continuous rate, and is collected in light and heavy fractions at the bottom of the apparatus.
A. J. M.

Filling closed-end mercury manometers. J. WERNER (Ind. Eng. Chem. [Anal.], 1938, 10, 645).—A simple method of filling, involving the use of a

Hyvac pump and a bulb, with narrow ends, to contain the Hg, is described. L. S. T.

Accurate micromanometer. C. C. WINDING and F. H. RHODES (Ind. Eng. Chem. [Anal.], 1938, **10**, 665—666).—The differential micromanometer described measures pressure differences $\Rightarrow$2·5 cm. of H_2O with an accuracy equal to that of the usual two-liquid manometers, and can be used for Pitot tube and pressure drop measurements in air ducts. The level of H_2O is measured by the completion of an electric circuit and by means of a micrometer screw. The electrodes are connected to a sensitive thyratron relay. L. S. T.

Absorption efficiency of spiral gas-lift wash-bottle. B. B. CORSON (Ind. Eng. Chem. [Anal.], 1938, **10**, 646—647).—A wash-bottle providing intimate and prolonged contact between gas and liquid with re-circulation and economy of liquid reagent is described. A comparison shows it to be more efficient than a bottle of the Drechsel type in removing CO_2 from a $N_2 + CO_2$ (~1%) mixture by means of KOH. With 4% KOH and gas rates of 3·8 to 11·5 l. per hr., an efficiency of 99·9 to 99·4% is obtained. L. S. T.

Glass-blowing accessories. W. A. CARLSON (Ind. Eng. Chem. [Anal.], 1938, **10**, 644—645).—A glass-blower's mouthpiece, designed to by-pass any gases given off on heating dirty glass, is described. A method of making ground-glass joints, and the use of rubber tape for making flexible, air-tight joints, are also described. L. S. T.

Stirrer driven from below without stuffing boxes. WOLLENBERG (Chem.-Ztg., 1938, **62**, 902).—The driving shaft passes up inside a fixed tube which ends above the liquid level, and the stirrer is carried on a concentric tube rotating outside the fixed tube. Compressed air may be admitted to the fixed tube if desired. G. H. C.

Glass-enclosed magnetic stirrer. J. H. SIMONS (Ind. Eng. Chem. [Anal.], 1938, **10**, 638).—The stirrer described and illustrated is useful in studying the reactions of small vols. of gases. It can be used with internal pressures $\Rightarrow$5 atm. L. S. T.

Apparatus for differential and integral catalytic hydrogenation. E. MANEGOLD and F. PETERS (Kolloid-Z., 1938, **85**, 310—317).—The pressure of H_2 in the reaction vessel is kept const. by replacement with electrolytically generated H_2. The current passing is thus a measure of the velocity of hydrogenation. The relative efficiencies of several catalysts for the hydrogenation of benzylideneacetone have been determined. In this reaction step-wise curves have been obtained, representing the attack of different double linkings. E. S. H.

Viscosimeter for investigation of the action of radiation on sols. J. LÖBERING and K. STAUNIG (Kolloid-Z., 1938, **85**, 279—289).—Apparatus is described. Results for several org. liquids and aq. salt solutions show no influence of ultra-violet light on η, but liquids with anomalous flow (gelatin, starch, and cellulose derivatives) suffer a decrease of η and a change in structure viscosity. E. S. H.

Water-jet blower. J. HALLER (Chem.-Ztg., 1938, **62**, 902).—Wasteful escape of air through the H_2O outlet may be stopped by fixing a small linen bag over the end of the tube which delivers air and H_2O into the closed vessel, and a metal baffle over the H_2O outlet. G. H. C.

Appliance for analysis of aërosols. A. G. AMELIN (Zavod. Lab., 1938, **7**, 878—879).—The gas is passed at the rate of $\Rightarrow$2 l. per min. through a glass spiral, on the walls of which the droplets are deposited by the centrifugal force developed. Complete separation of H_2SO_4 droplets from air is achieved with this device. R. T.

Use of piezo-quartz for registration of rapidly varying pressures. N. M. IVANOV (Zavod. Lab., 1938, **7**, 810—816).—Apparatus is described. R. T.

Checking pumping speeds. G. C. ELTENTON (J. Sci. Instr., 1938, **15**, 415).—The method, which is suitable for the rapid checking of the power of a pump, consists essentially of observing the time required for Hg to rise up a calibrated tube which is connected with the vac. line by means of a high-resistance capillary. C. R. H.

Combined still and diffusion pump. W. P. DAVEY and R. J. PFISTER (Physical Rev., 1937, [ii], **51**, 1028). L. S. T.

Production of liquid hydrogen without the use of a compressor. J. E. AHLBERG, W. O. LUNDBERG, and I. ESTERMANN (Physical Rev., 1937, [ii], **51**, 1028).—By using a special heat interchanger, and other simplifications in construction, a H_2 liquefier of small size has been built. The low heat capacity of the unit permits the operation of the liquefier from ordinary H_2 cylinders without the use of a compressor. Using liquid N for precooling ~16% of the H_2 could be liquefied at a flow of 1·6 cu. ft. per min., giving ~0·9 l. of liquid H per hr. The consumption of liquid N is ~7 l. per l. of liquid H. L. S. T.

Polishing apparatus for ore minerals. J. MURDOCH (Econ. Geol., 1938, **33**, 542—553).—Details and illustrations of mounting the specimens in bakelite and polishing by Vanderwilt's method (*ibid.*, 1928, **23**, 292) are given. L. S. T.

Vacuum regulator. C. W. FERRY (Ind. Eng. Chem. [Anal.], 1938, **10**, 647—648).—A modification of the Ellis (A., 1932, 925) const.-pressure device for vac. distillation regulates pressure below 30 mm. to such an extent that no variations can be detected on a manometer read with a lens. L. S. T.

Greaseless vacuum valves. C. H. TOWNES (Rev. Sci. Instr., 1938, **9**, 428—429).—Two vac. valves not involving the use of grease are described. One is a magnetically operated Hg valve; the other, for use in a horizontal position, employs Hg and graphite. A. J. M.

Radiometer-type vacuum gauge. A. E. LOCKENVITZ (Rev. Sci. Instr., 1938, **9**, 417—420).—A radiometer-type vac. gauge which can be calibrated from its dimensions is described. When made of metal it covers a range of 2—0·01 dyne per sq. cm.,

but when made of glass the lower limit is 0·001 dyne per sq. cm.   A. J. M.

Device to protect large vacuum systems against accidental interruptions of the mechanical pump. J. P. YOUTZ (Rev. Sci. Instr., 1938, **9**, 420—421).   A. J. M.

Continuous still for production of metal-free water. J. R. FISHER (J. Austral. Inst. Agric. Sci., 1938, **4**, 152—154).—An all-glass apparatus is described. A siphon system maintains a const. level of H_2O in the distilling flask.   A. G. P.

Universal apparatus for extraction and distillation. G. NOTTES (Chem.-Ztg., 1938, **62**, 891—892).—An apparatus for the extraction of solutions or solids with solvents of $\rho >$ or < 1, followed, if required, by a distillation and recovery of the solvent, is described and illustrated.   L. S. T.

Small, low-temperature rectifying column. J. H. SIMONS (Ind. Eng. Chem. [Anal.], 1938, **10**, 648).—The column described has a capacity of ~5 c.c. of liquefied gas, operates at const. pressure, and is suitable for the purification and fractionation of small quantities of gases generated in reactions, and for liquids boiling at −130° to −50°.   L. S. T.

Automatic mercury still.—See B., 1939, 53.

Odourless hydrogen sulphide system. I. LIN (J. Chem. Educ., 1938, **15**, 545).—A method for minimising the escape of H_2S into the laboratory is described.   L. S. T.

Dipiperidyls as absorbents for carbon dioxide. —See B., 1939, 8.

Geochemistry.

Present trends in geochemistry. R. C. WELLS (J. Chem. Educ., 1938, **15**, 524—532).—An address.   L. S. T.

Occurrence of helium and the accompanying geological and physical phenomena. A. MAYER-GÜRR (Oel u. Kohle, 1938, **14**, 977—983).—The world's He resources are briefly discussed.   A. B. M.

Distribution of helium and radioactivity in rocks. I. Mineral separates from the Quincy granite. N. B. KEEVIL (Amer. J. Sci., 1938, [v], **36**, 406—416).—The quartz, ferromagnesian minerals (riebeckite and ægirite), and felspar (mainly microperthite) of this granite have been separated and their He, Ra, U, and Th contents determined. The calc. ages are quartz 86±5, riebeckite and ægirite 86±5, and felspar 49±3×10⁶ years. The weighted age calc. from these data and the mineral composition is 68±4×10⁶ years, in agreement with the age of 62±2×10⁶ years determined for the granite itself. The relatively low He content and age of the felspar are probably due to excessive crystal imperfections. Most of the Ra, Th, and He are associated with the ferromagnesian minerals, the high age of which shows that there is no tendency of the He to diffuse to a uniform concn. throughout the rock during geological time. The average vals. for the Quincy granite are He 3.9×10^{-5} c.c. per g., Ra 10.6×10^{-13} g. per g., U 3.0×10^{-6} g. per g., and Th 9.3×10^{-6} g. per g.   L. S. T.

Phosphate in the English Channel, 1933—1938, with a comparison with earlier years, 1916 and 1923—32. L. H. N. COOPER (J. Marine Biol. Assoc., 1938, **23**, 181—195).—PO_4 records at the International Hydrographic Station E 1, off Plymouth, from Aug. 1930 to Aug. 1938, expressed in mg.-atom of P per cu. m. and corr. for salt error, are recorded. Similar records for Station E 2 for 1930—1936 are also given. At E 1, the winter max. for PO_4 averaged 0·67 mg.-atom of P per cu. m. for 1923—4 to 1928—9, and only 0·47 mg.-atom for 1930—1 to 1937—8. This decrease is closely correlated with the

abundance of summer-spawning young fish. The years are classified in order of phytoplankton productivity on the basis of spring PO_4 consumption. Surface regeneration of PO_4, probably from decomp. org. material, is discussed.   L. S. T.

Hydrology and plankton of the North Sea and English Channel. M. GRAHAM and J. P. HARDING (J. Marine Biol. Assoc., 1938, **23**, 201—206).—PO_4, salinity, and temp. records of waters of the North Sea have been compared for April or May in 1935, 1936, and 1937, and the plankton distribution recorded. A high PO_4 content is associated with extremes of salinity and temp. in similar areas in each year. The PO_4 appears to be brought into the North Sea and Channel by oceanic H_2O and by drainage from the land. The plankton organisms were similarly distributed in each year.   L. S. T.

Distribution of phosphates in the southwestern area in April 1938. C. F. HICKLING (J. Marine Biol. Assoc., 1938, **23**, 197—200).—PO_4 was abundant at all depths in three regions, viz., off the Bristol Channel, off the English Channel, and on the edge of the Continental Shelf west of Cornwall. These regions appeared to be associated with the outflow of the Bristol Channel, the flow of more oceanic H_2O across the entrance of the English Channel, and with upwelling of deeper H_2O at the edge of the shelf, respectively. Surface H_2O contained less PO_4 than the deeper H_2O, and, in some cases, regions poor in PO_4 could be correlated with the rapid development of phytoplankton.   L. S. T.

Re-definition of the "anomaly of the nitrate–phosphate ratio." L. H. N. COOPER (J. Marine Biol. Assoc., 1938, **23**, 179; cf. A., 1938, I, 103).—This should be defined as the amount by which the NO_3-N/PO_4-P ratio differs from 15, each salt being expressed in mg. atoms, and PO_4 being corr. for salt error by the appropriate factor, 1·35 (cf. supra).   L. S. T.

Analyses of the saline water containing iodine and alkaline earths from Varano Marchesi

(Parma). G. ILLARI (Annali Chim. Appl., 1938, **28**, 369—378).—Composition and physico-chemical data are recorded.   O. J. W.

Dichotomous microstratification of p_H. K. SUGAWARA (Proc. Imp. Acad. Tokyo, 1938, **14**, 316—319).—The new type of stratification of p_H reported for the epilimnion of Lake Takasuka-Numa differs from types described previously since it appears during the day, and disappears during the night owing to circulation of H_2O through cooling; its development is accompanied by a heavy O_2 consumption in the corresponding H_2O zone and is confined to a comparatively narrow zone. The stratification is due to the swarming of organisms consuming O_2 and liberating CO_2, the accumulation of which results in the observed fall in p_H at the locality.   L. S. T.

Dissolved oxygen of the lake waters of Japan. S. YOSHIMURA (Sci. Rep. Tokyo Bunrika Daigaku, 1938, **2**, 63—277).—Data for temp., p_H, and $[O_2]$ at various depths, in mid-summer and winter, are recorded for 205 Japanese lakes and 3 enclosed bays. $[Cl']$ are also recorded in certain cases. The lakes are classified as (i) oligotrophic, (ii) mesotrophic, (iii) eutrophic, (iv) dystrophic, and (v) acidotrophic according to their biological productiveness. The stratification of O_2 during mid-summer in lakes of various types is discussed in detail. The % saturation on the surface of certain lakes ranges from 95 to 105; highly eutrophic lakes show supersaturation, whilst some dystrophic and acidotrophic lakes are undersaturated even at their surfaces. A large excess of O_2 in the middle depths of some meso- and eu-trophic lakes is due to assimilation by blue algæ and diatoms. Microstratification is common, and is due to large absorption of O_2 by the bottom mud and to the large vertical gradient in the ρ of the H_2O. Anaërobic layers up to 32 m. thick occur in many lakes. The non-freezing lakes are almost saturated with O_2 from top to bottom in winter.   L. S. T.

Gold content of sea-water. W. E. CALDWELL (J. Chem. Educ., 1938, **15**, 507—510).—Former investigations are reviewed. New determinations by the method described previously (A., 1938, I, 47) show that sea-H_2O from the Oregon Coast and Puget Sound contains a max. of ~0·1—0·2 mg. of Au per metric ton. The [Au] in sea-H_2O is ≪ is generally supposed.   L. S. T.

Distribution of iodine in German salt deposits. Reasons for the presence and absence of iodine in different horizons of the Zechstein formation, and in petroleum waters. J. ROEBER (Kali, 1938, 209—211, 221—223, 233—236).—The I contents of the complete profiles of the Zechstein formation in the Mariaglück, Salzdetfurth, Krügershall, Stassfurt, Volkenroda, and Kaiseroda mines, and of certain petroleum waters are recorded and discussed. Compared with the older series of rocks, the I deficiency in the younger rock-salt and potash salt is marked. In salt layers containing Fe^{III}, the I content is ≪ in the white or grey layers containing little or no Fe. An explanation of this is advanced. Details of I enrichment in certain of the salt constituents such as kieserite, sylvite, etc. are discussed. I distribution in the German salt deposits has occurred in a homogeneous manner and the largest amounts of I appear in combination with org. substances. Contrary to former assumptions, certain horizons of the salt profiles contain a larger [I] which occasionally persists throughout whole strata. A method for isolating and determining traces of I from natural salts is described.   L. S. T.

Deposit of sediment in the western Mediterranean. L. BERTHOIS (Compt. rend., 1938, **207**, 1062—1064).—Analytical data for 22 samples of sediment dredged from the western Mediterranean are discussed.   W. R. A.

Maria Elena meteorite. V. B. MEEN (Amer. Min., 1938, **23**, 661—664).—The meteorite is an octahedrite consisting mainly of kamacite with moderately abundant taenite. Plessite and troilite are scarce. The analysis is Fe 94·52, Ni 4·88, Co 0·131, Cu 0·010, P 0·052, S 0·029, C 0·007, Pt etc. none, total 99·63%.   L. S. T.

New meteorites from Western Australia. E. S. SIMPSON (Min. Mag., 1938, **25**, 157—171).—Accounts are given of 14 meteorites (11 siderites, 2 stones, and one seen to fall and not yet found), of which 8 are new, bringing the total no. known from Western Australia up to 23. Chemical analyses are given of two siderites, and in other cases a determination of Ni. The chemical composition, structure, and circumstances of finding prove that the Mount Stirling and Mooranoppin siderites are part of the Youndegin fall.   L. J. S.

Petrographic character of the eruptive series of Jebel Sarro, Moroccan Antiatlas Mts. S. GHIKA-BUDESTI (Compt. rend., 1938, **207**, 1056—1058).   W. R. A.

Serpentines in northern Karelia. P. HAAPALA (Bull. Comm. géol. Finlande, 1936, No. 114, 80 pp.; Chem. Zentr., 1937, i, 46).—Ultrabasic rocks composed of serpentines, antigorite, talc, and magnesite are described.   A. J. E. W.

New graphite deposit in the region of Krasnaya Polyana in North Caucasus. A. G. TITOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 371—372).—Small deposits of graphite are found in clay shales.   F. J. G.

Content of rare earths in the Kara-Tau phosphorites. S. A. BOROVIK and T. A. BUROVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 369—370).—The phosphorites contain 0·13% of rare earths, chiefly the Y group.   F. J. G.

Synthesis and investigation of biotite. D. P. GRIGOREEV (Compt. rend Acad. Sci. U.R.S.S., 1938, **20**, 391—392).—A typical fluorbiotite has been synthesised and its crystallo-optical characteristics are described.   F. J. G.

Quartz-rich sediments with green cement from the Keuper of Franconia. E. CHRISTA (Tsch. Min. Petr. Mitt., 1938, **50**, 357—390).—Petrographical descriptions with chemical analyses of sandstones containing chamosite are given.   L. J. S.

Red gneisses of the Saxon Erzgebirge and adjoining regions. K. H. SCHEUMANN (Tsch. Min. Petr. Mitt., 1938, **50**, 391—440).—The petrographical characters and chemical analyses of red gneiss from various localities are compared amongst themselves and with those of the grey gneiss.
        L. J. S.

Deposition of native copper under hydrothermal conditions. L. R. PAGE (Econ. Geol., 1938, **33**, 522—541).—The dissolution of Cu wire by dil. aq. NaCl, $CaCl_2$, Na_2SO_4, Na_2CO_3, and H_2CO_3 has been investigated by heating the wire and solution in absence of air at 200° or 300° in Au-lined steel bombs for periods up to 205 hr. On cooling, the Cu is deposited as crystals or irregular masses of native metal. When Na ions are present, some basic salt or hydroxide accompanies the pptd. Cu. With aq. NaCl at 300° in presence of a limited $[O_2]$, crystals of cuprite and amorphous CuO were also formed. The solubility of the Cu at 200° is $<$ that at 300°, and is greatest in aq. $CaCl_2$ and least in aq. Na_2SO_4 and aq. H_2CO_3. Solubilities in aq. Na_2CO_3 and aq. NaCl are approx. equal. At room temp. over periods ⊀ three years and in presence of limited amounts of air, Cu is dissolved to a small extent by aq. $CaCl_2$ and aq. NaCl and partly redeposited as carbonate and oxides. Datolite increases this solvent action, but calcite tends to decrease it. Under conditions similar to those employed in the case of Cu, Ag is dissolved and redeposited after heating with aq. $CaCl_2$ and aq. NaCl. These results and other considerations indicate that the native Cu and Ag of the Michigan and similar deposits may have been deposited at temp. $>100°$ by the cooling of Cu- and Ag-bearing solutions rich in $Na^{\cdot}$, $Ca^{\cdot\cdot}$, Cl', and possibly SO_4'', but relatively poor in Fe and S''.
        L. S. T.

" Red Beds " type copper occurrence, Wyoming Co., Pennsylvania. R. D. BUTLER (Econ. Geol., 1938, **33**, 625—634).—Exposures of Cu minerals in Catskill rocks of Devonian age show mineralisation of gray sandstones and shales intercalated with red strata. Compressed and mineralised plant remnants that are semi-bituminous or anthracitic have been observed. Epigenetic minerals are bornite (I), blue and white chalcocite (II), and chalcopyrite. Cracks in the altered plant remnants are filled by (I), and the well-preserved cell structures are due probably to replacement of the interiors by (I) and (II). Mineralisation probably occurred after metamorphism.
        L. S. T.

Manganese deposits of the Drum Mountains, Utah. E. CALLAGHAN (Econ. Geol., 1938, **33**, 508—521).—The general geology, structural relations, and production are described. The Mn deposits are interpreted as deposits of rhodochrosite (I) that replaced dolomite or limestone. Two varieties of (I), grey and pink (chemical analyses given), are present.
        L. S. T.

Manganese in the Montreal Mine, Montreal, Wisconsin. R. M. DICKEY (Econ. Geol., 1938, **33**, 600—624).—The mode of occurrence of manganite, pyrolusite, rhodochrosite (I), and minor amounts of psilomelane and associated minerals in the Mn–Fe ore bodies is described. The Mn minerals developed after the Fe ore bodies with which they are associated, the Mn being contributed probably by solutions of magmatic origin from an unknown, but possibly granitic, source. (I) was deposited first and then altered to Mn oxides and hydroxides by waters of the $CaCl_2$ type. Chemical analyses of mine waters are recorded.
        L. S. T.

Kalgoorlie geology re-interpreted. J. K. GUSTAFSON (Econ. Geol., 1938, **33**, 667—674).—A reply to criticism (cf. A., 1938, I, 283).
        L. S. T.

Crystallography of tsumebite. L. LaFORGE (Amer. Min., 1938, **23**, 772—782).—Tsumebite is monoclinic (cf. A., 1913, ii, 65, 145) with a 0·65462 and c 0·67451. The chemical analysis [F. A. GONYER] corresponds with $Pb_2Cu(PO_4)(OH)_3,3H_2O$.
        L. S. T.

Weathering of heavy minerals. K. H. SINDOWSKI (Z. deuts. Geol. Ges., 1938, **90**, 626—629).—Kaolinisation in the Eocene and Upper Pliocene probably proceeds under similar climatic conditions. The metamorphic heavy minerals, particularly garnet, are completely decomposed, whilst tourmaline, zircon, and rutile remain stable.
        L. S. T.

Tertiary volcanic rocks of central Victoria. A. B. EDWARDS (Quart. J. Geol. Soc., 1938, **94**, 243—320).—The rocks are classified on petrological and chemical bases, and many chemical analyses, 50 of them being new, are recorded. The following types are described and their probable sequence of extrusion established : (i) lavas : trachyandesites, sölvsbergites, trachyphonolites, anorthoclase-trachytes, anorthoclase-olivine-trachytes, olivine-trachytes, several types of basalts, limburgite, woodenite, and olivine-nephelinite, and (ii) Gabbroic types : norite, and pseudo-" essexite-gabbro." The minerals, felspars, iddingsite, pyroxenes, apatite, Fe ores, etc., are described separately. The evolution of the rock suite is discussed.
        L. S. T.

Origin of the iron ore deposits in the Bull Valley and Iron Springs Districts, Utah. F. G. WELLS (Econ. Geol., 1938, **33**, 477—507).—The general geology and the Fe ore deposits are described. Several chemical analyses are recorded. The deposits consist of veins of magnetite (I) and hæmatite (II) in monzonite, and (I)–(II) replacement bodies in limestone. Features characteristic of contact-metamorphic deposits are absent both in the ores and in the country rock. The origin of the deposits is explained by deposition of (I) and (II) from $FeCl_3 + H_2O$ liberated at a high temp.
        L. S. T.

Evolution of the Criffel–Dalbeattie quartz-diorite : study of granitisation. M. MacGREGOR (Geol. Mag., 1938, **75**, 481—496).—The geochemistry of a process of " granitisation " whereby greywackes and shales have been converted into quartz-diorite at the western end of the Criffell–Dalbeattie igneous complex is discussed in the light of new analyses, nine of which are recorded. The process appears to have been due to the uprise of a parent magma of alkali felspar composition.
        L. S. T.

Petrological studies in the Harlech Grit series of Merionethshire. I. Metamorphic changes

in the mudstones of the manganese shale group. A. W. WOODLAND (Geol. Mag., 1938, **75**, 366—382).— Normal and metamorphic types of mudstone are described and the metamorphism is discussed. Eight new chemical analyses are recorded.   L. S. T.

Petrological studies in the Harlech Grit series of Merionethshire. II. Petrography and petrology of some of the grits. A. W. WOODLAND (Geol. Mag., 1938, **75**, 440—454).—The heavy minerals of the Grits are also described.   L. S. T.

Paragenesis of pyrrhotite. G. M. SCHWARTZ (Econ. Geol., 1938, **33**, 568—570).—A reply to criticism (cf. A., 1938, I, 422).   L. S. T.

Geological observations of the Block P mine, Hughesville, Montana. K. SPIROFF (Econ. Geol., 1938, **33**, 554—567).—The principal ore minerals are galena (I), sphalerite (II), pyrite, chalcopyrite (III), and tetrahedrite (IV). Ag predominates over Au; Cd, Ge, and traces of Co, Ni, and Sb are also present. The Ag is associated with (I), (II), (III), and (IV), the Cu sulphides carrying the largest amount. The ore veins were deposited by hydrothermal solutions. Chemical analyses of the rocks of the area are recorded.   L. S. T.

Montmorillonite from the Mehmel summit (Thüringia). H. JUNG (Naturwiss., 1938, **26**, 739).—An outcrop of montmorillonite on the summit of the Mehmel shows properties similar to that discovered at Dolmar (A., 1936, 1483). Both are probably of hydrothermal origin.   A. J. M.

Transformations of magnesian prochlorites under the action of heat. J. ORCEL and (MLLE.) S. CAILLÈRE (Compt. rend., 1938, **207**, 788—790).—The dehydration on heating of a no. of prochlorites has been studied with reference to Debye–Scherrer diagrams. The calcination products are peridote, spinel, and sillimanite.   A. J. E. W.

Petrographic studies on the ash of the Quizapu volcano (Chile). K. SZTRÓKAY (Földtani Közlöny, 1936, **66**, 122—128; Chem. Zentr., 1937, i, 48).—A wind-graded specimen (particle size 0·02—0·05 mm.) obtained 1200 km. from the crater contained SiO_2 69·41, TiO_2 0·37, Al_2O_3 14·64, Fe_2O_3 0·43, FeO 1·29, MnO 0·05, MgO 0·97, CaO 2·16, K_2O 3·89, Na_2O 4·96, H_2O- 1·19, H_2O+ 1·78, and P_2O_5 0·23%.   A. J. E. W.

Volcanic rocks resistant to the corrosive action of liquid acids. G. MALQUORI and F. PENTA (Ric. sci. Progr. tecn. Econ. naz., 1936, [ii], **7**, II, 335—338; Chem. Zentr., 1937, i, 48).—Ease of attack by acids (H_2SO_4, d 1·8, and conc. HCl) is reduced with increasing [SiO_2], basic constituents reacting most readily.   A. J. E. W.

Volcanism and the chemistry of magmas. A. RITTMANN (Chem.-Ztg., 1938, **62**, 889—890).—A review illustrating the bearing of physico-chemical processes on geochemistry.   L. S. T.

Heavy elements in desert sand. P. BELLAIR (Compt. rend., 1938, **207**, 1054—1056).—Samples of sand from the eastern and western portions of the Sahara have been examined. Western sands contain zircon, muscovite, titaniferous minerals, tourmaline, and considerable quantities of magnetite, whilst in eastern sands zircon is exceptional, muscovite abundant, and magnetite rare, but occasionally rutile, red garnet, staurolite, tourmaline, and sphene (titanite) are found. A suggested interpretation of these differences is given.   W. R. A.

Hydrolysis of calcium felspar. L. T. ALEXANDER and H. G. BYERS (Amer. Soil Survey Assoc., Rept. 16th Ann. Meet. Bull., 1936, **17**, 21—23).— Powdered anorthite after alternate electrodialysis and grinding in a ball mill was hydrolysed to a material resembling soil clay. After several months it showed little change in SiO_2, R_2O_3, or MgO content but most of the Ca was replaced by combined H_2O. The product differed from kaolinite but resembled halloysitic acid; its p_H alternated from 6·0 to 3·8 after drying and dialysis, respectively, and the buffer and NH_3 absorptive capacities were > those of certain soil clays.   CH. ABS. (p)

New analyses of lepidolites and their interpretation. R. E. STEVENS (Amer. Min., 1938, **23**, 607—628).—17 new analyses of lepidolites from different localities indicate that Rb and Cs are normal constituents of these minerals and that vals. for K_2O given in former analyses may be too high. The analyses appear to agree with the structural requirements of micas as revealed by the X-ray investigations of other workers. A new analysis of polylithionite (I), an end member of the lepidolite series, shows the formula to approximate closely to $K \cdot Li_2Al \cdot Si_4O_{10}F_2$. Nb and Ti appear to be normal constituents of lepidolites close to (I) in composition. The composition of the 17 lepidolites approximates closely to that of isomorphous mixtures of (I) with biotite $K \cdot R''_3 \cdot AlSi_3O_{10}(OH,F)_2$, lithium muscovite $K_4 \cdot Li_6Al_6 \cdot Al_4S_{12}O_{40}(OH,F)_8$, and muscovite $K \cdot Al_2 \cdot AlSi_3O_{10}(OH,F)_2$. Evidence indicating discontinuous isomorphism is discussed, and a division of lepidolites into types based on five ideal formulæ is suggested.   L. S. T.

Crystallography of braunite from Nagpur, India. G. SWITZER (Amer. Min., 1938, **23**, 649—653).—X-Ray measurements give a_0 13·23 and c_0 18·77 A.   L. S. T.

Crystallography of meyerhofferite. C. PALACHE (Amer. Min., 1938, **23**, 644—648).—Measurements on 14 crystals give $a : b : c = 0 \cdot 7904 : 1 : 0 \cdot 7763$, α 90° 41', β 101° 51', and γ 86° 44'. X-Ray measurements give a_0 6·60, b_0 8·33, c_0 6·48 A. (all ±0·02 A.), α 91° 00', β 101° 31', γ 86° 55' (all ±0° 05'), $a_0 : b_0 : c_0 = 0 \cdot 792 : 1 : 0 \cdot 778$; vol. of unit cell 348·83 A.³, and using ρ 2·12, mol. wt. 448·18.   L. S. T.

Brookite crystals in the Dogger of N.-E. Yorkshire. R. H. RASTALL (Geol. Mag., 1938, **75**, 433—440).—The many different varieties of brookite occurring in various rocks from this district are described.   L. S. T.

Status of hornblende in low-grade metamorphic zones of green schists. C. E. TILLEY (Geol. Mag., 1938, **75**, 497—511).—Chemical analyses

of chlorites, several hornblendes, and hornblende and chlorite schists are recorded. L. S. T.

Petrology of Barnavave, Carlingford, I.F.S. III. Hybrids from the E. and S.E. slopes of Barnavave Mountain. S. R. NOCKOLDS (Geol. Mag., 1938, 75, 469).—Chemical analyses of eucrite and modified eucrite are included. L. S. T.

Occurrence of wavellite at Giles Co., Virginia. L. C. ARTZ (Amer. Min., 1938, 23, 664—665). L. S. T.

Problems of the Pre-Cambrian. E. S. MOORE (Trans. Roy. Soc. Canada, 1938, [iii], 32, III, 1—10).—An address. L. S. T.

The Sudbury intrusive. A. B. YATES (Trans. Roy. Soc. Canada, 1938, [iii], 32, III, 151—172).—The geological sequence of events, consisting of various intrusions, has been determined from a study of the rocks concerned. Variations in the sp. gr. of the norite and micropegmatite are discussed. Chemical analyses and mineral composition of the norite, micropegmatite, and offset dykes are given. L. S. T.

The Steeprock series. E. S. MOORE (Trans. Roy. Soc. Canada, 1938, [iii], 32, III, 11—23).—This series of igneous and sedimentary rocks contains some comparatively pure, blue to grey limestone and a large amount of $FeCO_3$, approaching ankerite in composition, which has formed by replacement of limestone, tuff, lava, and other rocks. In places this carbonate contains several % of Mn, and has given rise to large amounts of hæmatite and some Mn sediment. Chemical analyses of the limestone and the $FeCO_3$ are recorded. L. S. T.

Elasticity of certain rocks and massive minerals. F. BIRCH and D. BANCROFT (Amer. J. Sci., 1939, 237, 2—6; cf. A., 1938, I, 480).—Vals. at room temp. and pressure for Young's modulus, rigidity, Poisson's ratio, and the velocities of waves of compression and of distortion are recorded and discussed for syenite porphyry, silicified volcanic ash, diabase and metadiabase, massive magnetite, pyrrhotite, and pyrite from the Noranda Mines, Ontario, and for obsidian, diabase, bronzitite, and hypersthenite from other localities. The elasticity of the massive pyrite and magnetite is discussed in terms of the elastic coeffs. of single crystals of these substances. L. S. T.

High-pressure behaviour of miscellaneous minerals. P. W. BRIDGMAN (Amer. J. Sci., 1939, 237, 7—18).—Calcite has two new transitions, one at ~14,000 kg. per sq. cm. almost independent of temp. between 0° and 200°, and the other from ~17,000 kg. per sq. cm. at 0° to 28,000 kg. per sq. cm. at 200°. Compressibility up to 50,000 kg. per sq. cm. has been measured. The pressure–temp. phase diagram is reproduced. Measurements of the compressibility of quartz glass up to 50,000 kg. per sq. cm. show that the known abnormal increase with a rise in pressure ceases abruptly at ~35,000 kg. per sq. cm., after which compressibility decreases with a rise in pressure in the normal way. The compressibility of artificial basalt glass becomes practically const. between 25,000 and 50,000 kg. per sq. cm. For pressures up to 50,000

kg. per sq. cm. at room temp. and at 150°, no transitions could be detected with certainty in diabase, anorthosite, dunite, or granite, but pyroxenite (I) probably shows a transition. Shearing revealed no transitions in olivine, felspar, obsidian, and artificial basalt, but (I) gave evidence of transition. Wurtzite is irreversibly changed to sphalerite by shearing at room temp. L. S. T.

Experiments bearing on the orientation of quartz in deformed rocks. D. GRIGGS and J. F. BELL (Bull. Geol. Soc. Amer., 1938, 49, 1723—1746).—The literature concerning quartz deformation is reviewed, and the different theories are briefly compared. New determinations confirm the increase in strength of quartz (I) with confining pressures up to 20×10^3 atm. Except for the production of undulatory extinction in (I) broken under high pressures, there is no evidence of plastic behaviour in (I) under high pressure. Under moderate confining pressures at 400° in presence of 10% aq. Na_2CO_3, quartz cylinders break under 4000 atm. differential pressure to form needles. Indications of plastic flow are again absent. The significance of these experiments in tectonics is discussed. L. S. T.

Igneous rocks of the Crazy Mountains, Montana. J. E. WOLFF (Bull. Geol. Soc. Amer., 1938, 49, 1569—1626).—Numerous chemical analyses are presented and discussed. Some mineral analyses and variation diagrams are also given. The richness of the rocks in Ba and Sr points to a common magma. L. S. T.

Petrology of the Pennsylvanian underclays of Illinois. R. E. GRIM and V. T. ALLEN (Bull. Geol. Soc. Amer., 1938, 49, 1485—1513).—Underclays of various types occurring beneath the coals in Illinois have been examined, and the mineral composition determined by optical, X-ray, and chemical methods, frequently after sedimentation and separation into fractions by centrifuging. The non-calcareous underclays are composed mainly of kaolinite, with varying amounts of illite and quartz. The calcareous underclays and those grading to non-calcareous contain illite as the essential clay mineral. Numerous chemical analyses show that in the non-calcareous clays there is no appreciable vertical variation in composition downwards from the coal. Base-exchange data are recorded. The origin of the clays is discussed. L. S. T.

Parahilgardite, a new triclinic-pedial mineral. C. S. HURLBUT, jun. (Amer. Min., 1938, 23, 765—771).—*Parahilgardite* from the Choctaw Salt Dome, Louisiana, has $a : b : c$ 0·5045 : 1 : 0·2783, α 90° 00′, β 90° 00′, γ 91° 12′, a_0 11·24, b_0 22·28, c_0 6·20 A. (X-ray), n_X 1·630, n_Y 1·636, n_Z 1·664. The unit cell corresponds with $2[Ca_8(B_6O_{11})_3Cl_4,4H_2O]$. The physical properties are identical with those of hilgardite (A., 1938, 1, 50). A chemical analysis [F. A. GONYER] is given. L. S. T.

Potash analcime and pseudoleucite from the Highwood Mountains of Montana. E. S. LARSEN and B. F. BUIE (Amer. Min., 1938, 23, 837—849).—These minerals and their occurrence are described, and their origin is discussed. Chemical analyses are recorded. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MARCH, 1939.

Determination of Rydberg constants for hydrogen and deuterium. V. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 347—350).— The Rydberg consts. for H and D are 109,677·75 and 109,707·56 cm.$^{-1}$, respectively. Vals. for a no. of other consts. are calc. from these. F. J. G.

Fine structure of H_a and D_a. S. PASTERNACK (Physical Rev., 1938, [ii], **54**, 1113).—The divergence between experimental and theoretical vals. of the doublet separations of H_a and D_a is consistent with a perturbation of the 2^2S level of D, and this leads to results agreeing fairly well with the measurements of Williams (cf. A., 1939, I, 1). Support is found by a consideration of discrepancies observed in the doublet separations of other Balmer lines of H_2. N. M. B.

Intensities of electronic transitions in molecular spectra. I. Introduction. II. Charge-transfer spectra. R. S. MULLIKEN (J. Chem. Physics, 1939, **7**, 14—20, 20—34).—The problem of the abs. intensities of electronic transitions in mol. spectra is discussed generally, and the relevant general equations are explained.

II. Theoretical. The two related types of high-intensity mol. spectra, the " charge-resonance " and the " charge-transfer " spectra, are discussed with reference to their origin. For both, equations are derived in which the dipole strength $\propto$ the distance across which the charge resonates or is transferred. Experimental data on the charge-resonance spectra in H_2^+, O_2^+, and NO, and the $N \rightarrow V$ (charge-transfer) transitions in the spectra of H_2, O_2, C_2H_4, C_6H_6, and the halogens agree with the theory. W. R. A.

Connexion between strengthening and weakening of series by the electric field. R. RITSCHL and R. SIKSNA (Physikal. Z., 1938, **39**, 898—899).—Determination of the intensity of the spectrum emitted by a He positive-ray tube in an electric field shows that with the occurrence of forbidden transitions there is a weakening of those transitions starting from the same upper state. The variations of intensity of the forbidden transitions ($2p$—$4p$ and $2p$—$5p$) increases at first with the square of the field strength, but for $2p$—$4p$ becomes horizontal at 180 kv. per cm. and for $2p$—$5p$ reaches a max. at 150 kv. per cm. A. J. M.

Rotational analysis of the first negative band spectrum of oxygen. T. E. NEVIN (Phil. Trans., 1938, A, **237**, 471—507).—Using the method previously described (A., 1938, I, 107), the (1, 0), (0, 0), and (0, 1) bands of the first negative system of O_2^+ have been photographed, and each band has been analysed into 40 branches, the transition involved being $^4\Sigma \rightarrow {}^4\Pi$. The fine structure of the $^4\Sigma$ level agrees with the theoretical structure given by Budó (A., 1937, I, 271). The $^4\Pi$ level is inverted, the $^4\Pi$ state probably being perturbed. The intensity of the R_3 and P_2 branches is very low. The mol. consts. of O_2^+ in the initial $^4\Sigma$ and final $^4\Pi$ states are obtained from the analysis. A. J. M.

Pressure shifts of the high terms of the absorption series of Na, Rb, and Cs produced by hydrogen and nitrogen. N. T. ZÉ and C. S. YI (Physical Rev., 1938, [ii], **54**, 1045—1047; cf. A., 1937, I, 272).—Data and curves for measurements for different concns. of the perturbing gas up to ~12 atm. (617° K.) for H_2 and 7·5 atm. (548° K.) for N_2 are given. H_2 produced a strong, and N_2 a very slight, shift. The effective cross-sections calc. by Fermi's equations were 14·0 and 2·0 sq. cm. per c.c., respectively. For axially symmetrical mols. the effective cross-sections calc. from Fermi–Reinsberg equations do not agree with those obtained by a direct electrical method. N. M. B.

Optical L spectra of the elements chromium to cobalt in the extreme ultra-violet. F. TYRÉN (Z. Physik, 1938, **111**, 314—317; cf. A., 1938, I, 486).—By means of the grating previously described the L spectra of Cr xv, Mn xvi, Fe xvii, and Co xviii are obtained. The lines cover the range 12—22 A. All four elements give 7 lines of a Ne i-like spectrum and the first three exhibit two lines of a higher series. The term systems and the abs. term vals. are calc. L. G. G.

Extension of the 1^1P_1—m^1S_0 series of zinc. H. BRUCK (Compt. rend., 1938, **207**, 1194—1195).— $\lambda\lambda$ and intensities of lines for $m = 7$—9 have been determined, using a jet of Zn vapour excited by electron bombardment. A. J. E. W.

Hyperfine structure in the spark spectrum of arsenic in the ultra-violet. S. K. MUKERJI (Indian J. Physics, 1938, **12**, 331—340).—The chief lines of the spark spectrum of As in the region 3200—2400 A. have been examined with a quartz Lummer plate, and an analysis of the hyperfine structure has been attempted. J. A. K.

Spectrum of rubidium in the far ultra-violet (2000—1050 A.). R. RICARD and F. VALANCOGNE (Compt. rend., 1938, **207**, 1093—1094).—The $\lambda\lambda$ and relative intensities of 92 lines are recorded. W. R. A.

Persistence of molecular vibration in collisions. R. J. DWYER (J. Chem. Physics, 1939, **7**, 40—44).—A spectroscopic experiment has been devised to test the theory that the exchange of energy in collisions between mol. translation and rotation on the one hand, and vibration on the other, is slower

than between, e.g., the different translational degrees of freedom. I_2 mols., raised from the ground level to the first excited vibrational level, persist in this level through several thousands of collisions with other I_2 mols. before losing their vibration. The method is not quant.   W. R. A.

Cæsium discharge under conditions of nearly complete ionisation. F. L. MOHLER (J. Res. Nat. Bur. Stand., 1938, **21**, 697—706).—Using radiation from a 1-mm. capillary tube, measurements of the intensity distribution of the continuous recombination spectrum were used to measure electron concn., N_e, and electron temp., T_e, up to 300 amp. c.d. and 17 mm. pressure. Full data are plotted and show that with increasing c.d. the intensity reaches a flat max. which increases as the square of the pressure. Above 0·3 mm. pressure T_e is independent of pressure and increases linearly with current. Results agree quantitatively with the theory that the Cs in the capillary is in temp. equilibrium at a temp. T_e and a pressure equal to the v.p. Electrical measurements of T_e and N_e in a 5-mm. tube and pressure range 0·0045—0·3 mm. show that in this range T_e increases with decreasing pressure. The gas temp. is not in equilibrium with T_e, and N_e has a val. > that corresponding with temp. equilibrium.   N. M. B.

Mechanical moment of $^{171, 173}$Yb, quadrupole moment of ^{176}Yb, and relative abundance of ^{173}Yb to ^{171}Yb. H. SCHÜLER, J. ROIG, and H. KORSCHING (Z. Physik, 1938, **111**, 165—173).—From the hyperfine structure of the Yb I lines $\lambda\lambda =$ 6489, 6799, and 7699, the nuclear mechanical moments of ^{171}Yb and ^{173}Yb are respectively 1/2 and 5/2. The quadrupole moment (weighted mean) of ^{173}Yb is $+3·9 \times 10^{-24}$. Comparison of the intensities of components of the lines gives the ^{173}Yb/^{171}Yb abundance ratio as 1·14, which is < Aston's estimate of 1·89.   L. G. G.

Magnetic moment of $^{171, 173}$Yb and isotope displacement of Yb I. H. SCHÜLER and H. KORSCHING (Z. Physik, 1938, **111**, 386—390; cf. preceding abstract).—Further treatment of earlier work gives the magnetic moments of ^{171}Yb and ^{173}Yb as $+0·45$ and $-0·65$, respectively. From the 5556 A. line the isotope displacement ($6s^2$ configuration) is $\sim0·03$ cm.$^{-1}$ By comparison with term differences in the spectra of known elements, the abs. val. of the ground term of Yb II is $96,180\pm2000$ cm.$^{-1}$ L. G. G.

First spark spectrum of platinum. A. G. SHENSTONE (Phil. Trans., 1938, A, **237**, 453—470).—A list of all identified lines of the spectrum of Pt II between λ 976 and 1242, and of all certain low-transition lines and identified high-transition lines between λ 1242 and 4514, is given. The ionisation potential is 18·47 v. from $5d^9\ ^2D_{2\frac{1}{2}}$ to $5d^8\ ^3F_4$.   A. J. M.

Influence of electric quadrupole moments on the Paschen–Back hyperfine structure effect and the structure of the mercury line 2537 A. T. SCHMIDT (Z. Physik, 1938, **111**, 332—337).—Formulæ are given for the energy levels in the Paschen–Back effect with hyperfine structure, taking nuclear quadrupole moments into account; these are applied to the measurements of Buhl on the Hg resonance line λ 2537.   H. C. G.

Width and displacement of spectral lines in the high-pressure mercury discharge. P. SCHULZ (Physikal. Z., 1938, **39**, 899—902).—" Statistical " and " collision " widths are distinguished as limiting cases. The former are due to comparatively long interaction of the radiating atom with its neighbouring atoms, whilst the latter are due to the short-lived but very intense perturbation on the approach of a foreign atom to the radiating atom. The statistical widening is unsymmetrical, is displaced towards the red, and is of importance at higher pressures. The collision widening is symmetrical. The widening of the 2^1P_1 term is produced by collision of the radiating atom with atoms of a similar kind, that of the $3D$ terms by collisions with electrons. At 20 and 80 atm. the width of the 2^1P_1 term is < expected, whereas that of the $3D$ terms is in agreement with theory. The asymmetry of the Hg triplet system increases with increasing pressure. The displacement of lines with pressure is small, and is usually towards the red. Terms with large collision width are displaced somewhat more and towards the violet.   A. J. M.

Radiation of wave-length 2537 A. in the low-pressure mercury discharge. F. RÖSSLER and F. SCHÖNHERR (Physikal. Z., 1938, **39**, 902—906).—The efficiency of the Hg line 2537 A. as a function of the current strength and of the Hg pressure has been determined for the discharge in Hg at low pressures, with and without the addition of Ne. With addition of Ne the characteristic behaviour of the alkali metals was reproduced. At low pressures and low current strength the greatest efficiency of the 2537 A. line was 60%. For the discharge in Hg without Ne a totally different curve was obtained, but the max. efficiency was again 60%. The current strength- and pressure-efficiency curves show definite max. the height and position of which depend on the pressure (p) and current strength (i), respectively. At the max. $ip^3 =$ const. The efficiency of the radiation of λ 1850 A. was also estimated. It is considerably < expected. The results are discussed.   A. J. M.

Temperature influence on the pressure broadening of spectral lines. H. HORODNICZY and A. JABŁOŃSKI (Nature, 1938, **142**, 1122).—The broadening of the Hg absorption line 2537 A. caused by He is not dependent on temp.   L. S. T.

Effect of collisions on the intensities of nebular lines. I. S. BOWEN and R. MINKOWSKI (Nature, 1938, **142**, 1079—1080).—A discussion (cf. A., 1938, I, 590).   L. S. T.

New types of electric arcs. II. Arcs with one electrode consisting of very varied fused non-metallic substances. M. PIERUCCI and L. BARBANTI-SILVA (Nuovo Cim., 1938, **15**, 265—272; cf. A., 1936, 655).—The characteristics of arcs in which one electrode consists of a fused substance (salts, oxides, hydrates) or mixture are described.   O. J. W.

" Ghosts " of lines produced by diffraction gratings. F. PASCHEN (Ann. Physik, 1939, **34**, [v], 129—135).—" Ghosts " at a distance of < 0·01 A. from

the true lines have been identified in the spectrum of In (A., 1938, I, 53) produced by a concave grating of Rowland's first series. Similar ghosts are reported for the Tübingen grating of Rowland's second series.   O. D. S.

Effect of chemical combination on K fluorescent X-ray emission lines. L. OBERT and J. A. BEARDEN (Physical Rev., 1938, [ii], 54, 1000—1004). —The width and index of asymmetry of the fluorescent $K\alpha_1$, $K\alpha_2$, and $K\beta_1$ emission lines of pure Zn, Cu, Fe, Mn, Cr, and 26 compounds were measured with a double-crystal spectrometer. Agreements with results previously obtained by direct excitation by electron impact (cf. A., 1936, 1169) indicate that the shape of the lines is independent of the method of excitation. A study of the Cu and Fe halide and sulphide lines shows some regularities in the change of width and index of asymmetry with % composition.   N. M. B.

Fine structure of X-ray absorption K-edge of α-, β-, and γ-iron. D. COSTER and H. LEVI (Physica, 1939, 6, 44—46).—The K-edge of γ-Fe at 940° shows a definite fine structure agreeing with that found with face-centred cubic lattices and differing from that given by α- and β-Fe, which resemble each other.   L. J. J.

Auger effect and relative intensity of L-emission lines. K. W. DE LANGEN (Physica, 1939, 6, 27—32, 240).—The Auger effect $L_1 \rightarrow L_{11}$ with ejection of an M-electron can occur with Zr and Nb, but not with Mo. Photographic intensity measurements show in the case of Zr and Nb a weakening of the $L\beta_3$ and $L\beta_4$ lines, which is absent for Mo. The satellites of $L\beta_1$ have a considerable intensity for elements of $Z < 41$, due to the same effect.   L. J. J.

Validity of X-ray crystal methods of determining e. V. L. BOLLMAN and J. W. M. DuMOND (Physical Rev., 1938, [ii], 54, 1005—1010).—In continuation of previous work (cf. A., 1936, 1316), experiments on selective reflexion from thin calcite slabs etched with HCl rather heavily over one face and over half of the opposite face conclusively disprove the contention that, in the X-ray determination of e, Bragg reflexion determines the lattice dimensions in only a shallow surface region whereas density determinations concern a much larger vol. of the crystal.   N. M. B.

Rigorous calculation of intensity and polarisation in continuous Röntgen spectra. G. ELWERT (Ann. Physik, 1939, [v], 34, 178—208).—Mathematical.   O. D. S.

Effect of thermal agitation on the intensity of reflexion of cathode rays from crystals. D. COSTER and P. G. VAN ZENTEN (Physica, 1939, 6, 17—26).—Comparison of intensity of cathode-ray reflexions from a Au film at 18° and 205° shows a definite temp. effect, giving a val. 160° K. for the Debye temp., in agreement with vals. derived from sp. heat and electrical conductivity measurements.   L. J. J.

Anomalous dispersion of X-rays in calcite. R. M. WHITMER and G. A. LINDSAY (Physical Rev., 1938, [ii], 54, 988—993).—Measurements of n for calcite were made in the range λλ 2880—3550, the region of the K absorption edge of Ca. The whole X-ray beam enters the crystal through an artificial face, ground so that after reflexion from the (100) planes a part of the beam emerges through this face at a sufficiently small angle for appreciable refraction; the separation of this and another part of the beam emerging from a cleavage face is a measure of n. The use of the continuous spectrum allows measurements as closely spaced in λ and as near the absorption edge as desired. A distinct dip in $(1-n)/\lambda^2$ near the absorption edge is found, and results are compared with Hönl's theoretical curve.   N. M. B.

Absorption of X-rays of wave-length $1.5 \leq \lambda \leq 8.3$ A. C. L. ANDREWS (Physical Rev., 1938, [ii], 54, 994—999).—Mass absorption coeffs. determined for Be, C, Al, Cu, Ag, and Au are tabulated and plotted and compared with available data. In the case of Be, a val. 100% higher, owing to the presence of ~1% of heavier impurities, than for the pure element suggests a method of microanalysis for heavy impurities in elements of low at. no.   N. M. B.

Spectroscopic determination of the atomic number of polonium. H. HULUBEI, (MLLE.) Y. CAUCHOIS, and (MME.) S. COTELLE (Compt. rend., 1938, 207, 1204—1206).—The measured λλ of the $L\alpha_1$, α_2, β_1, β_2, and γ_1 radiations of Po are in accord with Moseley's law. $L\beta_3$, β_4, β_6, and $\gamma_6\gamma_3$ have also been identified in the spectrograms.   A. J. E. W.

Connexion between field electron emission and emission work. R. HAEFER (Naturwiss., 1939, 27, 32).—Deviation in field electron emission of adsorbed layers from the val. given by wave mechanics theory is due to the formation of crystallites, the existence of which can be demonstrated by means of the field electron microscope in the case of Ba on W. For the investigation of the connexion between field electron emission and emission work only perfectly uniform layers can be used. Vaporised Cs is specially suitable for this, the vaporisation being sufficiently slow to give a monat. layer in 20 min. Investigations with Cs on W give results agreeing with the $\phi^{3/2}$ law (ϕ = emission work in v.).   A. J. M.

Secondary electron emission. R. KOLLATH (Physikal. Z., 1938, 39, 916—918; cf. A., 1938, I, 590).—An oscillograph method for investigating secondary emission, which gives the whole efficiency curve at any given time, and also allows the visual observation of the variation of the efficiency curve with time, is described. Three demonstration experiments with a projection oscillograph which show the diminished secondary emission from vaporised Be compared with that of the compact metal, and the effect of temp. on the secondary emission of compact Ni and vaporised Be, are described.   A. J. M.

Electronic waves. (SIR) J. J. THOMSON (Phil. Mag., 1939, [vii], 27, 1—32).—The results of experiments on electronic waves lead to the conclusion that all such waves have the same frequency, viz., 1.2×10^{20}. It is suggested that this is the frequency of the electronic spin. Since the velocity of electrons is ≪ that of light, the waves travel a circuitous path. The case of a regular helix is worked out, and it is shown that the electron does not lose energy by

radiation. Experiments on the velocity distribution of cathode rays analysed by magnetic deflexion are described. Instead of a continuous line corresponding with uniform distribution, a regular series of spots was observed in many cases, the sharpness of the spots depending on the nature and pressure of the gas. The effect is ascribed to collisions between the electrons and the gas, the electrons losing energy in integral amounts equal to the ionisation potential of the gas. The velocities of the electrons form regular series analogous to the Balmer series.   J. A. K.

Scattering of slow electrons in, and apparent electron affinity of, boron fluoride. R. P. SEWARD and J. H. SIMONS (J. Chem. Physics, 1939, 7, 2—3).—The scattering of slow electrons by BF_3 is similar to that observed with Hg vapour (A., 1939, I, 51), and is consistent with the proposed relationship between the scattering of a mol. and its electron affinity. A possible correlation is postulated between the electron affinity of BF_3 and the appearance of 4 diffuse bands in the visible region of the BF_3 spectrum.   W. R. A.

Electron temperature, T_e, in an alternating-current (50∼) positive column discharge. Experimental method. W. UYTERHOEVEN and C. VERBURG (Compt. rend., 1938, 207, 1386—1388).—The probe method of Langmuir and Mott-Smith (Gen. Elect. Rev., 1924, 27, 449) is modified for use with a.c.   A. J. E. W.

Dissociation of $C_2H_2D_2$ by electron impact. J. DELFOSSE and J. A. HIPPLE, jun. (Physical Rev., 1938, [ii], 54, 1060—1062; cf. Kusch, A., 1938, I, 4).—Data obtained in a mass-spectroscopic investigation are tabulated. The distribution of intensities of the different ions produced is interpreted by assuming a selective process, of calc. probability p, favouring the splitting of the C–H over the C–D linking, and from that val. of p the estimated intensity of the C_2HD ion agrees with measurements. It is shown that the formation of CH_2 in C_2H_4 is a splitting of the double linking between the C atoms alone, and that in the formation of H_2^+ in C_2H_4 the H atoms come from the same radical.   N. M. B.

Dissociation of benzene, pyridine, and cyclohexane by electron impact. A. HUSTRULID, P. KUSCH, and J. T. TATE (Physical Rev., 1938, [ii], 54, 1037—1044; cf. A., 1938, I, 4).—In a mass-spectrographic investigation 4 doubly charged and 31 singly charged positive ions were observed in the dissociation of C_6H_6. Relative abundance, for electrons of 72 v. energy, and the appearance potential are tabulated for each ion. The first and second ionisation potentials are 9.8 ± 0.1 and 17.2 ± 1.0 v., respectively. The ionisation potential of C_5H_5N is 9.8 ± 0.2, and of C_6H_{12} 11.0 ± 0.2 v. In each of the three vapours certain ions resulting from the dissociation process have a doublet character, the components having a const. energy separation independent of magnetic field, and having also different appearance potentials. These ions are interpreted as being formed by two different processes, one of which imparts a definite amount of kinetic energy to the ion.   N. M. B.

Scattering of α-particles by argon, oxygen, and neon. G. BRUBAKER (Physical Rev., 1938, [ii], 54, 1011—1017; cf. A., 1938, I, 224).—Using a special apparatus, the scattering in each case showed anomalies, and irregularities in the course of these are interpreted as resonance phenomena. Estimated radii of the nuclear barriers are: ^{16}O, 4.5×10^{-13}; ^{20}Ne, 4.6×10^{-13}; ^{40}A, 7.5×10^{-13} cm. The first two are $<$, and the last $>$, the calc. vals.   N. M. B.

Effect of electric field on oxygen atoms and water molecules in molecular beam experiments. H. SCHEFFERS (Physikal. Z., 1939, 40, 1—3).—The effect of a strong electric field on O atoms in the mol. beam is similar to that on H (A., 1936, 539). There is a deviation in the inhomogeneous electric field and the polarisability of O is ∼0.2×10^{-24}. H_2O also shows a deviation in the inhomogeneous field.   A. J. M.

Effect of positive-ray collisions on the polarisation of the light emission in a magnetic field. J. STARK and H. VERLEGER (Physikal. Z., 1938, 39, 896—898).—H positive rays were passed through He (0.1 mm. pressure) and transverse magnetic fields up to 20,000 gauss were applied. The intensity of the emitted light perpendicular (I_s) and parallel (I_p) to the field was determined. The ratio I_p/I_s for H_a, H_β, and H_γ decreases with increasing magnetic field, indicating a strengthening of the components vibrating perpendicular to the magnetic field. For a const. field I_p/I_s for H_β increased with decreasing pressure. In a longitudinal magnetic field the electric component vibrating parallel to the field is increased.   A. J. M.

Electron liberation through impact of positive ions on the cathode in a glow discharge. IV. Relation between γ values and the work of liberation of the electrons and the effect of this relationship on the mechanism of the normal glow discharge. A. GÜNTHER-SCHULZE, W. BÄR, and A. WINTER (Z. Physik, 1938, 111, 208—211; cf. A., 1938, I, 109, 337).—A continuation of work already noted.   L. G. G.

Sub-standards in mass-spectrography. J. MATTAUCH (Physikal. Z., 1938, 39, 892—896).—Precision determinations of the isotopic wts. of subsidiary standards used in mass-spectrography have been carried out with a double-focussing mass spectrograph by the doublet method. The val. obtained for ^{12}C is somewhat $<$ that of Bainbridge, but the vals. for ^{14}N, ^{20}Ne, and ^{40}A are rather larger. Aston's val. for ^{12}C is too low. With the exception of ^{40}A the differences lie within the added experimental error, thus making unnecessary any alteration in Bainbridge's scale. The isotopic wts. determined are $^{1}H = 1.008132\pm(0.038 \times 10^{-4})$, $^{2}D = 2.014726\pm(0.074 \times 10^{-4})$, $^{12}C = 12.003876\pm(0.32 \times 10^{-4})$, $^{14}N = 14.00756\pm(0.40 \times 10^{-4})$, $^{20}Ne = 19.99896\pm(0.66 \times 10^{-4})$, $^{40}A = 39.97564\pm(1.53 \times 10^{-4})$.   A. J. M.

Bands in mass-spectrography. J. MATTAUCH and H. LICHTBLAU (Physikal. Z., 1939, 40, 16—22).—Dissociation or discharge of the positive ray particles by collision with gas mols. in the space between the electric and magnetic fields in a mass spectrograph of

the Aston type gives rise to more or less wide bands in the spectrogram. In addition to the two bands discovered and explained by Aston, 26 further dissociation processes have been observed, concerning chiefly compounds of C, O, and H, which frequently occur in the positive rays. The position of the centre of the band is given by a simple formula which connects the mass and degree of ionisation of the particles before and after the discharge or dissociation process has occurred. The displacement of the band max. from the theoretical position observed by Aston is explained by the action of the magnetic field. Observations show that the collision is an effect without any essential transference of impulse from the stationary gas particles. The intensity and form of the max. give information on the type of decomp. suffered by the particles which agrees with the chemical constitution and electron affinity of the products. Discharge was also obtained with secondary electrons. A. J. M.

Formation of atomic groupings of radioactive elements. V. MAJER (Chem. Listy, 1939, **33**, 8—11).—Examination of the activity of Th-C'' with the aid of a Geiger–Müller counter reveals contamination with Th-B, -C, and -X; this is ascribed to recoil of groupings of atoms. R. T.

Influence of temperature on the formation and recombination of ions in α-ray columns. W. SEITTER (Ann. Physik, 1939, [v], **34**, 113—129).—Current–pressure curves for α-ray ionisation have been measured in air, Kr, and Ne, at pressures up to 1800 mm., voltages from 10 to 500 v., and temp. 20° and 220°. Results are analysed. The observed phenomena cannot be completely interpreted theoretically. O. D. S.

Coincidence measurements with α- and β-rays from radioactive arsenic. F. NORLING (Z. Physik, 1938, **111**, 158—164).—β–γ coincidences in the radioactive transformation of ^{76}As (half-life period 26 hr.) into ^{76}Se have been measured with Pb filters of thickness 0—0·4 g. per sq. cm. β–γ coincidences appear to be associated with both components of the spectrum although the no. of β–γ coincidences per 1000 β-particles decrease slightly with increasing β-energy. Results are discussed. H. C. G.

Production of pairs in nitrogen by γ-rays. L. V. GROSCHEV and I. M. FRANK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 273—275).—A max. in the no. of pairs produced in N_2 by radiation from Th-C'' occurs at 1600 e.kv. The average distribution of positrons and electrons according to energy is in accordance with the Bethe and Heitler theory, but their individual distributions are asymmetrical. The mean energy of positrons is > that of electrons and the difference, ~200 e.kv., is > the val. calc. from the effect of nuclear charge. O. D. S.

Absorption of γ-rays by barium sulphate, gypsum, water, and flesh. J. S. ROGERS (Brit. J. Radiol., 1934, **7**, 176—186).—Penetration data are recorded. CH. ABS. (e)

Effect of the shutter on the absolute determination of the r. unit. C. KÖNIG (Physikal. Z., 1939, **40**, 46—65).—The effect of secondary radiation

emitted by, and the transmission of, the shutter on the determinations of ionisation produced by X-rays is considered in relation to standardisation of the X-ray dose. A. J. M.

Neutrons in cosmic ultra-radiation. E. FÜNFER (Z. Physik, 1938, **111**, 351—356).—By measurements with a counter at various heights above sea level, with and without a borax shield, it is established that the no. of neutrons per min. increases rapidly with height, and more rapidly than the increase in total intensity of cosmic radiation or activity of showers. The no. of neutrons measured per unit time with a given counter is dependent on the nature of materials in its vicinity. L. G. G.

Composition of cadmium radiation excited by slow neutrons. R. FLEISCHMANN (Z. Physik, 1938, **111**, 281—291).—Absorption and coincidence measurements are reported and the emission of electrons from Cd is investigated. Thin Cd films emit few primary electrons; the coeff. of the inner photo-effect + pair formation is ~$(0·18\pm0·12) \times 10^{-2}$. H. C. G.

Angular distribution of transmuted particles in the transformations $D + D = {}^3H + p$ and $^{11}B + p = {}^8Be + \alpha$. H. NEUERT (Physikal. Z., 1938, **39**, 890—892).—The unsymmetrical distribution of the transmuted nuclei in the processes. $D(D; p)^3H$ and $^{11}B(p; \alpha)^8Be$ depends to a considerable extent on the energy of the colliding particles. The investigations were carried out with potentials up to 200 kv. A. J. M.

Angular distribution of protons emitted in the process $^6Li + D \rightarrow {}^7Li + {}^1H$. H. NEUERT (Naturwiss., 1939, **27**, 30).—Investigation of the processes $^6Li + D \rightarrow {}^7Li + {}^1H$ or $\rightarrow {}^7Li + {}^1H + \gamma$ with proportional counters shows that for potentials of 200—300 kv. there is a considerable variation in the abundance of protons emitted at different angles. More particles are emitted in the direction of the positive rays than perpendicular to them. The abundance ratio increases with increasing energy of the deuterons, and reaches the val. 1·7 for the process $^6Li + D \rightarrow {}^7Li + {}^1H$ at 290 kv. Protons from the less frequently occurring process, $^6Li + D \rightarrow {}^7Li + {}^1H + \gamma$, with a range of approx. 25 cm. show the same angular distribution over the range of potentials used above. A. J. M.

Resonance processes in the disintegration of boron by protons. B. WALDMAN, R. C. WADDEL, D. CALLIHAN, and W. A. SCHNEIDER (Physical Rev., 1938, [ii], **54**, 1017—1020).—The yields of long-range α-particles and γ-rays from the disintegration of B by protons of energy 150—195 e.kv. were measured simultaneously. Curve shapes indicate that the yields for the two processes are proportional and that the resonances occur at approx. the same voltage, 165±4 e.kv., as determined by α-particle yield. Both resonance processes probably involve the same level in the excited ^{12}C nucleus. Oppenheimer's theoretical deductions (cf. A., 1938, I, 290) are discussed. N. M. B.

Internal targets in the cyclotron. R. R. WILSON and M. D. KAMEN (Physical Rev., 1938, [ii],

54, 1031—1036).—The large circulating ion current in the cyclotron has been utilised to produce a high concn. of very active radioactive Fe and P. Technique for the enhancement of yields of radioactive materials is discussed in detail.   N. M. B.

Proton-induced radioactivities. II. Nickel and copper targets. C. V. STRAIN. **III. Zinc and selenium targets.** J. H. BUCK (Physical Rev., 1938, [ii], 54, 1021—1025, 1025—1030; cf. A., 1938, I, 291).—II. Ni bombarded with 6·3-Me.v. protons shows activities of half-lives 10·5±0·6 min., 3·4±0·3 hr., and 12·8±0·8 hr., corresponding with known periods of ^{62}Cu, ^{61}Cu, and ^{64}Cu, respectively. The corresponding β-ray energies obtained by the absorption method are 2·8, 1·2, and 0·68 Me.v. Thick target excitation curves are given. Cu bombarded with 6·3-Me.v. protons shows activities of half-lives 38·3±0·5 min. and 235±20 days, due to ^{63}Zn and ^{65}Zn, respectively. The ^{63}Zn positrons have 2·3±0·15 Me.v. max. energy. A thick target excitation curve shows a threshold proton energy of 4·1±0·1 Me.v. Average (thick target) cross-section for the ^{63}Cu $(p; n)^{63}Zn$ reaction is 0·28 × 10⁻²⁵ sq. cm.; for protons of energy 6·1 Me.v. it is 0·95×10⁻²⁵ sq. cm.

III. Zn bombarded with 6·5-Me.v. protons shows activities of half-lives 18·0±0·5 min., 72±4 min., 9·4±0·2 hr., and 84·4±2·0 hr., corresponding with ^{70}Ga, ^{68}Ga, ^{66}Ga, and ^{67}Ga, respectively, and a new period 48±2 min. assigned to ^{64}Ga. Thick target curves for ^{64}Ga, ^{68}Ga, and ^{70}Ga are given. Se bombarded with 6·3-Me.v. protons shows activities of half-lives 6·3±0·2 min., 17·4±0·5 min., 4·4±0·3 hr., and 33±1 hr., corresponding with ^{78}Br, ^{80}Br (2), and ^{82}Br, respectively. ^{80}Br threshold discrepancies (cf. Snell, A., 1938, I, 8) are confirmed. Thick and thin target excitation curves are given. The cross-section for the production of the ^{80}Br isomerides by the ^{80}Se $(p; n)$ reaction is 0·82 × 10⁻²⁵ for short and 0·22 × 10⁻²⁵ sq. cm. for long periods, at 6·3-Me.v. proton energy. The ratio of the two cross-sections rises from 3·6 at 6·3 Me.v. to >200 at 3·2 Me.v.   N. M. B.

Detection and behaviour of the alkaline-earth metals produced by irradiation of uranium by neutrons. O. HAHN and F. STRASSMANN (Naturwiss., 1939, 27, 11—15).—Three isomeric Ra nuclei are formed in the first instance by irradiation of U by neutrons (cf. A., 1939, I, 5). They are detected, and their half-life periods are determined, by co-pptn. with $BaCl_2$ in the presence of conc. HCl. Ra II, Ra III, and Ra IV have half-life periods 14±2 min., 86±6 min., and 250—300 hr., respectively. A further isomeric Ra nucleus, Ra I, may also exist as the parent substance of the unstable Ac isotope (half-life ~3 min.). Its half-life is <1 min. When attempts were made to enrich Ra II, III, and IV by fractionally crystallising the mixture with $BaCl_2$, the activity was uniformly distributed in all the Ba fractions, and no enrichment could be effected, in contrast to results obtained with Ra itself and the Ra isotopes $MsTh_1$ and Th-X. It follows that the isomeric Ra II, III, and IV have the properties of Ba. An isomeric Ac nucleus, Ac II, the product of β-ray disintegration of Ra II, is shown to have the properties of La.   A. J. M.

Nuclear isomerism : application of the method of coincidence counting to the investigation of the γ-rays emitted by uranium-Z and the radioactive silver ^{106}Ag. N. FEATHER and J. V. DUNWORTH (Proc. Roy. Soc., 1938, A, 168, 566—585).—The application of the method of coincidence counting by electrical means to the study of the time-correlation of nuclear processes is described. The investigation of the γ-rays from U-Z shows that the emission of two quanta in succession occurs in a very large fraction of disintegrations. The long-lived modification of ^{106}Ag emits 4 or 5 quanta in succession.   G. D. P.

What are cosmic-rays ? W. F. G. SWANN (J. Franklin Inst., 1938, 226, 757—796).—A crit. survey of contemporary experimental and theoretical evidence is given, and a new form of theory based on the principle that large energy losses can occur from the primary rays is developed.   N. M. B.

Secondary actions of the weak and penetrating components of ultra-radiation. B. TRUMPY (Z. Physik, 1938, 111, 338—344).—The radiation was passed through an automatic Wilson cloud chamber divided into compartments with sheet Pb. The various secondary reactions thus observed are discussed.   H. C. G.

Penetrating component of cosmic radiation. P. H. CLAY (Physica, 1939, 6, 82—83).—Differing absorption curves above and below an atm. depth of 60 m. H_2O can be explained by decay of barytrons according to Heisenberg and Euler's theory.   L. J. J.

Energy-rich nuclear process of ultra-radiation. E. M. SCHOPPER and E. SCHOPPER (Physikal. Z., 1939, 40, 22—26).—Traces of heavy particles and transmutation products of nuclei produced by ultra-radiation were obtained directly in a photographic emulsion. The energy and type of particle concerned are obtained from the grain density of the trace. Traces of protons and α-particles were obtained in addition to those of energy-rich nuclei.   A. J. M.

Theory of coincidence experiments on cosmic rays. N. ARLEY (Proc. Roy. Soc., 1938, A, 168, 519—546).—A theoretical investigation of the cascade theory of showers gives satisfactory agreement with experiment for the absorption and the Rossi transition curves. The no. of electrons having energy < the crit. energy of the shower-producing material is calc.   G. D. P.

World-wide changes in cosmic-ray intensity. S. E. FORBUSH (Physical Rev., 1938, [ii], 54, 975—988).—Continuous data over 17 months obtained at four widely separated localities are plotted and co-ordinated and results are discussed comprehensively.   N. M. B.

Theory of effect of earth's magnetic field on cosmic rays. (A) M. S. VALLARTA. (B) W. F. G. SWANN. (C) T. H. JOHNSON. (D) S. A. KORFF (J. Franklin Inst., 1939, 227, 1—35).—(A) A summary of results obtained by analysis of the motion of charged particles in the earth's magnetic field is given. The main cone, within which particles of a given energy may arrive at a given point on the earth's surface, the shadow cone, outside which no particles of a given

·energy can reach a given point on the earth, and the penumbra between the two cones within which certain directions are allowed, are discussed. The longitude and latitude effects and the effect of galactic rotation are also considered. The effect of the sun's permanent magnetic field on cosmic ray intensity is mentioned.

(B) Criticism of part of the above paper is offered.

(c) Criticism of the above paper in respect of statements on the longitude effect is made.

(D) The longitude effect of cosmic rays is discussed. The effect is about 4% at sea-level, and remains at this val. up to ~3·5 m. H_2O equiv., above which it increases, reaching $25 \pm 10\%$ at an elevation corresponding with 1 m. H_2O. A. J. M.

Geomagnetic effects and their bearing on the fundamental problems of the cosmic-ray investigation. T. H. JOHNSON (J. Franklin Inst., 1939, **227**, 37—58).—The variation of cosmic-ray intensity with latitude and longitude is discussed, and the evidence concerning the nature of the primary cosmic radiation afforded by geomagnetic effects is summarised. The reasons for supposing the soft component to be made up of equal nos. of positive and negative particles, the penetrating radiation to be entirely positive, and the radiation in external space to be neutral are given. The origin of the primary penetrating radiation is discussed and it is supposed that heavy electrons are produced when high-energy protons collide with matter. A. J. M.

Identification of Hoffmann collisions with electron showers produced by cosmic rays. A. DAUVILLIER (Compt. rend., 1938, **207**, 1392—1393).—Simultaneous recording by an ionisation chamber (N_2 or A at 90—100 atm.) and by triple coincidence counters shows that Hoffmann collisions are due to cosmic showers. Collisions causing liberation of 25×10^6 ion-pairs, representing an energy of 0.4×10^9 e.v., have been observed. A. J. E. W.

Multiple transmutation of atomic nuclei by cosmic rays. Results from 154 transmutation " stars " on photographic plates. H. WAMBACHER (Physikal. Z., 1938, **39**, 883—890).—At. nuclei in the emulsions of photographic plates were transmuted by long exposure to cosmic rays. The nuclear particles produce black traces on the emulsion, the intensity of which is a measure of the ionising power of the transmuted particles. By the examination of long tracks an empirical curve showing the connexion between grain density and range of the particles is obtained. The energy of the particles, which were produced from the following atoms in the film in order of frequency : C, O, N, Br, Ag, S, was determined from the curve. 154 " stars " with 3—14 tracks were investigated. The sum of the proton energies of each star amounted to about 150 Me.v. There was a definite displacement of the energy distribution of the emitted particles with rising temp. of the nuclei. A. J. M.

Electromagnetic energy of a point charge. M. H. L. PRYCE (Proc. Roy. Soc. 1938, A, **168**, 389—401).—Two difficulties are met with in the point model of an electron; the first is that the field becomes infinite at the charge, and the second that the ordinary expression leads to infinite electromagnetic energy in the neighbourhood of the charge. The author shows that the latter difficulty can be removed. G. D. P.

Experimental investigation of de Broglie's equation. J. G. TAPPERT (Physical Rev., 1938, [ii], **54**, 1085—1088).—By means of an experiment in which a beam of cathode rays is kept at const. deflexion in an electrostatic field and the relation between the intensity of the deflecting field and the de Broglie λ determined, the validity of the equation is demonstrated for 24—64-e.kv. electrons. N. M. B.

Potential barriers and the solution of the Schrödinger equation. M. DATZEFF (Ann. Physique, 1938, [xi], **10**, 583—673).—Mathematical. For the case of one dimension, any potential barrier is resolved into a series of rectangular barriers, and the relation of the problem with wave theory is developed leading to two solutions of the Schrödinger equation, one of these being identical with the Brillouin–Wentzel approximation. The barrier method is generalised for the solution of the wave-equation for two particles, and a solution of the Dirac equation in the case of a single variable is derived. N. M. B.

Wave-mechanical problem of two centres. N. SVARTHOLM (Z. Physik, 1938, **111**, 186—194).—A survey of the various types of solution for the wave-mechanical problem of two centres together with a new calculation of the ground state of the ionised H_2 mol. by means of an explicit wave function. H. C. G.

The elementary particle. W. WILSON and (MISS) J. CATTERMOLE (Phil. Mag., 1939, [vii], **27**, 84—93).—Mathematical. The theory developed requires that the creation of an electron (*e.g.*, when a β-particle is emitted in radioactive disintegration) must be associated with that of a positron which remains in the nucleus. Spin momentum is conserved without the need of the neutrino. J. A. K.

Neutron–proton scattering. K. C. KAR and D. BASU (Phil. Mag., 1939, [vii], **27**, 76—83).—Theoretical treatment of the binding energy of the deuteron and the scattering of neutrons. J. A. K.

Nuclear two-body variational problem. W. RARITA and Z. I. SLAWSKY (Physical Rev., 1938, [ii], **54**, 1053—1054; cf. A., 1937, I, 391).—Mathematical. It is shown that for calculations in nuclear problems the variational method is accurate and rapidly convergent. N. M. B.

Spacing of energy levels in light nuclei. L. MOTZ and E. FEENBERG (Physical Rev., 1938, [ii], **54**, 1055—1059).—From considerations based on the single-particle model statistical data and analyses for light nuclei ($A \leq 16$) are tabulated and discussed. N. M. B.

Isomerism of the nuclei of uranium-*Z* and uranium-*X*$_2$. N. N. DMITRIEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 289—291).—Using the formula of Bethe (A., 1938, I, 7) and the energy level scheme of Feather and Bretscher (*ibid.*, 338), the excitation energy, ε, and the difference of spin vals., *l*, between the level of U-*Z* and the ground level of U-*X*$_2$ are calc.; ε, 51·2 e.kv. and *l*, 4. O. D. S.

Binding energy of ^{16}O. W. J. KROEGER (Physical Rev., 1938, [ii], **54**, 1048—1053; cf. Inglis, A., 1938, I, 383).—Mathematical. A perturbation calculation giving first-, second-, and third-order contributions to the binding energy is developed. N. M. B.

Wave mechanics of the heavy electron. J. GÉHÉNIAU (Compt. rend., 1938, **207**, 1173—1175).—The current–density vector and characteristic magnetic moment are considered, the heavy electron being represented by 16 $\Phi_{\alpha\beta}$ wave functions. A. J. E. W.

Calculation of the position and width of the energy band of the valency electrons in alkali metals. P. GOMBÁS (Z. Physik, 1938, **111**, 195—207).—A method of calculation based on the Ritz approximation is developed and applied to metallic K. The first three approximations are worked out and the convergence of the process is demonstrated. In the third approximation the vals. $-6\cdot04$ e.v. for the lower edge and $+0\cdot28$ e.v. for the upper edge are obtained for the energy band of K. H. C. G.

Problem of electron interaction in metals. L. E. GUREVITCH (Compt. rend Acad. Sci. U.R.S.S., 1938, **20**, 355—360).—Mathematical. F. J. G.

Equations capable of representing a photon. J. ROUBAUD-VALETTE (Compt. rend., 1938, **207**, 1177—1180).—Mathematical. A representation in five dimensions is developed. A. J. E. W.

Relations between the theory of the photon and the theory of the heavy electron. (MME.) M. A. TONNELAT (Compt. rend., 1938, **207**, 1180—1182).—Mathematical. A. J. E. W.

Symbolical equation combining the equations of the mesotron (heavy electron), those of Kemmer and of Klein and Gordon, and L. de Broglie's equations of the photon. A. PROCA (Compt. rend., 1938, **207**, 1182—1184).—Mathematical. A. J. E. W.

Rotational structure of the $^3\Sigma \rightarrow {}^3\Pi$ bands of BF. F. W. PAUL and H. P. KNAUSS (Physical Rev., 1938, [ii], **54**, 1072—1077; cf. A., 1936, 775).—Full data in the rotational analysis of the (0,0), (0,1), (0,2), and (1,0) bands of the A system of BF are tabulated. Interpretation and calc. consts. are given. N. M. B.

Band spectrum of aluminium fluoride AlF. T. YUASA (Sci. Rep. Tokyo Bunrika Daigaku, 1938, **3**, A, 239—248).—The band spectrum of AlF, excited by vaporising AlF_3 or $AlF_3,3NaF$ at 700° and 2—3 mm. pressure, was photographed in the region 4176—3187 A. Full data and vibrational analyses are tabulated and consts. are calc. The computed lower level nuclear distance is 1·625 A., a val. intermediate between those for SiN and SiF, and approximating to the val. 1·62 A. of the isoelectronic mol. SiO. N. M. B.

Spectrum of lead hydride. W. W. WATSON (Physical Rev., 1938, [ii], **54**, 1068—1071).—From a Pb arc in H_2 at 4—5 atm. pressure, a " many-lined " spectrum in the region 5000—7000 A. due to PbH was produced. Assignments of nearly all the lines to 10 bands constituting a $^2\Sigma \rightarrow {}^2\Sigma$ transition between an upper state of low stability and a stable ground state ($\omega_e = 1565\cdot2$, $B_e = 4\cdot972$) are tabulated. Strong interaction with other states is shown. N. M. B.

Analysis and interpretation of the spectra of neodymium salts. H. EWALD (Ann. Physik, 1939, [v], **34**, 209—236).—The absorption spectra at liquid H_2 temp. of $Zn_3Nd_2(NO_3)_{12},24H_2O$ (I), $Mg_3Nd_2(NO_3)_{12},24H_2O$, $Nd(NO_3)_3,6H_2O$, $Nd_2(SO_4)_3,8H_2O$, $Nd(BrO_3)_3,9H_2O$, and $NdCl_3,6H_2O$, and in most cases of the corresponding salts with D_2O of crystallisation, have been measured. The strong sharp lines are identified with electronic transitions; the weak sharp lines with combinations of electronic transitions with anion, or H_2O, vibrations; and the weak diffuse lines, the position of which is strongly influenced by isomeric substitution in the mol., with combinations of electronic transitions with lattice vibrations (cf. Van Vleck, A., 1937, I, 165). $\lambda\lambda$ are tabulated for (I) from 4800 to 7450 A. O. D. S.

Absorption spectra of complex platinum compounds. A. V. BABAEVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 365—368).—The ultra-violet absorption spectra of a no. of complex Pt salts have been determined. $[Pt(NH_3)_4]Cl_2$ shows a single band, max. 290 mμ. Replacement of NH_3 by Cl or NO_2 gives rise to a new band, max. 335—340 mμ. In addition all Cl complexes show a steep rise at >450 mμ., and all complexes containing N in an acido-group show a narrow band, max. 265 mμ. The spectra of *cis*- and *trans*-isomerides differ only slightly. F. J. G.

Emission of short ultra-violet radiation during formation of structures. A. I. RABINERSON and M. V. FILIPPOV (J. Phys. Chem. Russ., 1938, **11**, 688—701).—When $Fe(OH)_3$, V_2O_5, or Na oleate is pptd. by Na_2SO_4, KCl, or NaCl respectively, radiation is emitted. Like mitogenetic radiation, it can be detected by a Geiger counter or by yeast. Addition of H_2O alone to the sol or the salt solution has no effect. Coagulation of As_2S_3 by NaCl involves no radiation. J. J. B.

Light absorption of hydrocarbons on the basis of quantum mechanics. T. FÖRSTER (Physikal. Z., 1938, **39**, 925—928).—It is possible by means of Slater's approximation method of quantum mechanics to obtain a qual. expression for the position of the ultra-violet and visible absorption ranges of hydrocarbons. For a series of condensed ring systems, including C_6H_6, $C_{10}H_8$, anthracene, naphthacene, pentacene, phenanthrene, and pyrene, quant. treatment gives good agreement with experimental data. A. J. M.

Ultra-violet absorption spectra of normal propyl and butyl iodides. G. MILAZZO (Gazzetta, 1938, **68**, 747—763; cf. A., 1936, 1048).—A more detailed description of the absorption spectra of $Pr^\alpha I$ and $Bu^\alpha I$ in the region 2120—1950 A. Band frequencies are recorded, and the possible electronic and vibrational states involved are discussed. A comparison is made with the absorption spectra of MeI and EtI. O. J. W.

Ultra-violet absorption spectra of *iso*propyl and tertiary butyl iodides. G. MILAZZO (Gazzetta, 1938, **68**, 763—778; cf. preceding abstract).—The absorption spectra of $Pr^\beta I$ and $Bu^\gamma I$ have also been studied and discussed. For these two compounds a series of oscillations in which the I atom does not take part have been found.   O. J. W.

Determination of constitution on the basis of spectra of solutions. H. LEY and H. SPECKER (Ber., 1939, **72**, [B], 192—202).—The effects of substitution and of salt-formation on absorption spectra are discussed with special reference to lactam-lactim tautomerism, and the conclusion is reached that such measurements will not necessarily afford a distinction. Extinction curves from 1800 to 3600 A. are recorded for MeOH solutions, with and without the addition of NaOMe, of $NPh\vdots CMe\cdot NHPh$, benziminazole, 1 : 2 : 3-benztriazole, and carbostyril (also in aq. NaOH), and for MeOH solutions of N- and O-methylcarbostyril, $NH\vdots CPh\cdot OEt$, NH_2Bz, NHBzMe, $NBzMe_2$, NH_2Ph, NHPhMe, and $NPhMe_2$.   F. J. G.

Structure of rhodamines from their absorption spectra. (MME.) P. RAMART-LUCAS (Compt. rend., 1938, **207**, 1416—1418).—Similarity of the absorption spectra (6000—2500 A.) enables similar p-quinonoid structures to be assigned to rhodamine bases, salts, and esters. Lactone and carbinol structures are proposed for the colourless anhyd. and hydrated bases.   A. J. E. W.

Emission of ultra-violet rays by chemical reactions. R. AUDUBERT (Trans. Faraday Soc., 1939, **35**, 197—204; cf. A., 1938, I, 230).—A review of reactions which take place with the emission of ultra-violet radiation with particular reference to the photogenic reactions accompanying the thermal decomp. of azides.   W. R. A.

New Coriolis perturbation in the methane spectrum. I. Vibrational–rotational Hamiltonian and wave functions. II. Energy levels. H. A. JAHN (Proc. Roy. Soc., 1938, **A**, **168**, 469—495, 495—518).—The infra-red absorption band of the low-frequency fundamental vibration (v_4) of CH_4 has a rotational structure more complex than would be expected for such a simple mol. It is shown that this complexity is consistent with a regular tetrahedral model. The rotational levels of the vibration v_4 are perturbed by the rotational levels of the next nearest vibration v_2 to produce the observed spectrum. In Part I the Coriolis (or vibrational gyroscopic) coupling terms in the Hamiltonian are derived and the wave functions are deduced. Tetrahedrally irreducible harmonic functions are tabulated up to the 10th quantum no. In Part II the perturbations of v_4 are calc.   G. D. P.

Infra-red absorption spectra of aliphatic and aromatic carbon compounds. II. P. LAMBERT and J. LECOMTE (Ann. Physique, 1938, [xi], **10**, 503—582; cf. A., 1933, 113).—With improved technique and a new recording spectrometer, investigations in the region 7—20 μ. were made for about 50 org. compounds. Transmission curves and band position diagrams are given and discussed. A direct relation between chemical structure and the positions of infra-red absorption max. is found and can be applied to identifications. Results are interpreted with the help of the theory of mol. vibrations and the relations of the spectra to those of other derivatives are shown.   N. M. B.

Structure of the O–H bands in the vapours of halogen-substituted alcohols. L. R. ŽUMWALT and R. M. BADGER (J. Chem. Physics, 1939, **7**, 87).—The third harmonic of the O–H band of primary alcohols is a doublet (10,510 and 10,460 cm.$^{-1}$) (A., 1937, I, 9). In $CH_2Cl\cdot CH_2\cdot OH$ (I) and $CH_2Br\cdot CH_2\cdot OH$ an additional doublet appears at 10,367 and 10,318 cm.$^{-1}$, whilst in trimethylene chloro- and bromo-hydrin the spectrum is identical with that of the primary alcohol. Propylene chloro-hydrin gives an intense component at 10,326 cm.$^{-1}$ in addition to the ordinary band of a *sec.* alcohol at 10,460 cm.$^{-1}$ In $OH\cdot CH(CH_2Cl)_2$ two intense bands at 10,243 and 10,325 cm.$^{-1}$ appear and the characteristic bands of *sec.* alcohols are undetectable. The influence of temp. on the relative intensities of O–H band components has been investigated. $Pr^\alpha OH$ is unaffected and thus the energy difference between the mol. configurations corresponding with the two components of the doublet is $\ll 800$ g.-cal. The intensity of the primary alcohol doublet of (I) increases greatly with increasing temp. but the intensity of the strong band at 10,367 cm.$^{-1}$ is diminished, indicating that the configuration corresponding with it is lower in energy than those responsible for the doublet. The estimated difference is ~ 2000 g.-cal. The data appear to indicate differences in the entropies of different " tautomeric " configurations of an alcohol.   W. R. A.

Infra-red absorption spectrum of benzoic acid. F. T. WALL (J. Chem. Physics, 1939, **7**, 87—88).—In addition to the band at 4·46 μ. recorded by Buswell *et al.* (A., 1938, I, 599) another band at 4·83 μ. has been obtained for BzOD in CCl_4. Thus BzOD, like BzOH, has two peaks due to H-bond vibrations.   W. R. A.

Infra-red transmission of several organic compounds near the m.p. R. TASCHEK and D. WILLIAMS (J. Chem. Physics, 1939, **7**, 11—13; cf. A., 1938, I, 554).—Isochromatics of $COPh_2$, $CO(CH_2Ph)_2$, $COPh\cdot CH_2Ph$, and benzylideneaceto-phenone have been studied. For $COPh_2$ and $COPh\cdot CH_2Ph$ a mesophase appears to exist near the m.p.   W. R. A.

Spectra of some methane derivatives in the far infra-red. M. PARODI (Compt. rend., 1938, **207**, 1196—1197).—$\lambda\lambda$ of absorption bands (17—65 μ.) are recorded for CH_2X_2, CHX_3 (X = Cl, Br, I), CCl_4, and CBr_4. Some of the bands are identified with vibrational vv; the remainder are probably combination vv, combination occurring in some cases with vv inactive in the infra-red.   A. J. E. W.

Statistical analysis of trends in research on the Raman effect. J. H. HIBBEN (Proc. Indian Acad. Sci., 1938, **8**, **A**, 294—300).   W. R. A.

Raman effect and multiple scattering of light. A. KASTLER (Proc. Ind. Acad. Sci., 1938, **8**, **A**, 476—

482).—The effect of several successive scatterings of light has been theoretically developed, and two methods are discussed by which the phenomena can be observed.   W. R. A.

Origin of new low-frequency Raman lines in solids. J. GUPTA (Indian J. Physics, 1938, **12**, 355—362).—Raman spectra of crystals of Na tartrate, tartaric acid, and $COPh_2$ have been measured and compared with published results for the same compounds in solution (or molten). Certain lines were always missing in the solid, but with tartaric acid and $COPh_2$ additional lines were observed near the Rayleigh line. It is concluded from a consideration of sp. heats that the new lines are not due to lattice vibrations, and weak intermol. forces are postulated instead.   J. A. K.

Low-frequency Raman lines in organic crystals. C. S. VENKATESWARAN (Proc. Ind. Acad. Sci., 1938, **8**, A, 448—459).—Low-frequency Raman displacements (20—130 cm.$^{-1}$) of 14 org. solids are given, and, for some, the effect of temp. up to the m.p. on the position and breadth of the lines has been investigated. All compounds containing the C_6H_6 nucleus yield 4 lines. These lines are considered as due partly to translational and partly to rotational oscillations of the mols. in definite phase relationship with each other. Salol glass at liquid air temp. shows neither a " wing " nor any line near the Rayleigh line, whereas liquid salol gives a fairly intense " wing." This observation is in contradiction to the hypothesis of Gross and Vuks that the liquid state is quasi-cryst. in structure and that " wings " in liquids are due to lattice oscillation (cf. A., 1937, I, 283). For liquid $COPh_2$, Ph_2, and Ph_2O a well-defined band replaces the line >100 cm.$^{-1}$ in the solids, which persists at high temp. and in dil. solutions. The band is attributed to a deformational oscillation of the two C_6H_6 rings against each other within the mol. itself.   W. R. A.

Coherent modified scattering of light. (SIR) C. V. RAMAN and C. S. VENKATESWARAN (Nature, 1938, **142**, 1116).—An explanation of the effects observed in interferometric studies of light scattering in fluids and solids is advanced. It is suggested that the frequency of the scattered light is the sum or difference of the frequency of the material particles and of the radiation frequency. In general, the scattered light should exhibit a continuous spectrum with max. of intensity depending on the direction of observation, rather than discrete frequencies as suggested by Brillouin's theory.   L. S. T.

Light-scattering in anisotropic media. H. MUELLER (Proc. Ind. Acad. Sci., 1938, **8**, A, 267—274).—The theory of Brillouin scattering of light in an anisotropic medium is developed, and from it have been calc. the influence of a uniform elastic strain on the intensity and depolarisation factors of the light scattered by glass. These quantities, which change rapidly when the forced birefringence reaches a magnitude of the order of the optical fluctuations in the glass, attain saturation vals. for large strains. The data are compared with those

of Krishnan for the scattering in a graphite sol under the influence of a magnetic field (cf. A., 1938, 1, 310).   W. R. A.

Depolarisation of unmodified light-scattering in liquids. B. D. SAXENA (Proc. Ind. Acad. Sci., 1938, **8**, A, 460—475).—The work of Ranganadham and of Rousset has been critically examined. In contrast to Rousset, it is concluded that normal liquids show a definite depolarisation of the unmodified scattering ρ which is considerably $<$ that of the total scattering ρ'. For viscous liquids, PhOH, $COPh_2$, and glycerol, ρ'−ρ is relatively small at room temp., and ρ diminishes with rising temp. For PhOH, between 23° and 175°, ρ'−ρ at the higher temp. is $>$ at the lower temp.   W. R. A.

Origin of the continuum in Raman spectra of electrolytes. L. GIULOTTO (Nuovo Cim., 1938, **15**, 273—278).—Raman spectra of H_2O and of solutions of HNO_3, KNO_3, $NaNO_3$, and $LiNO_3$ have been measured. The intensity of the continuous Raman spectrum varies with the degree of hydration of the ions and is attributed to oscillations in the hydrated ion complex.   O. J. W.

Chart of the Raman bands of water in crystals. P. G. N. NAYAR (Proc. Indian Acad. Sci., 1938, **8**, A, 419—423).—The Raman bands due to water of crystallisation have been investigated for 16 substances. These and existing data are reviewed.   W. R. A.

Raman spectra of volatile fluorides. Applications of Raman spectra to chemical problems. D. M. YOST (Proc. Indian Acad. Sci., 1938, **8**, A, 333—340).—An attempt to photograph the Raman spectrum of F_2 was unsuccessful. New data are recorded for SiF_4 and SOF_2. Available data on volatile fluorides and analogous chlorides and bromides are discussed from the viewpoint of mol. symmetry, force consts., entropies, and free energies.   W. R. A.

Scattering of light in sodium nitrate crystals. I. T. M. K. NEDUNGADI (Proc. Indian Acad. Sci., 1938, **8**, A, 397—404).—The Raman spectrum of a single crystal of $NaNO_3$ has been investigated at 25°, 100°, 200°, 250°, and 290°, also that of molten $NaNO_3$ at 320°. At higher temp. Rayleigh scattering increases. At 25° two lines, due to lattice oscillations, appear at 98 and 185 cm.$^{-1}$ but broaden about 6-fold at 290° and move towards the exciting line. Molten $NaNO_3$ gives a " wing." Doubt is cast on the view that the " wing " and the lattice lines have the same physical origin (A., 1937, I, 283). The changes brought about on the other displacements by increased temp. are discussed.   W. R. A.

Interpretation of Raman spectra in crystals : anhydrite and gypsum. S. BHAGAVANTAM (Proc. Indian Acad. Sci., 1938, **8**, A, 345—348).—The Raman spectra and X-ray analysis of anhydrite (I) and gypsum (II) have been interpreted by group theory. Both have ionic lattices and unit cells of 4 mols.; the crystals of (I) are orthorhombic, space-group V_5^{17}, whilst those of (II) are monoclinic, space-group C_{2h}^3. The SO_4'' ions appear to preserve their tetrahedral symmetry in the cryst. state. The four distinct modes of vibration of the tetrahedral SO_4'' ion are

split into nine distinct modes in the crystal because of the lower symmetry. These nine modes are split further because there are 4 mols. in the cell. All the split components should be active in Raman effect and do appear in the spectrum of (I). (II) gives general, but not complete, agreement with theory.

W. R. A.

Anomalous depolarisation of light-scattering in optical glasses. R. S. KRISHNAN (Proc. Indian Acad. Sci., 1938, **8**, A, 442—447).—A photographic-photometric method is described for demonstrating the existence of anomalous depolarisation in optical glasses. Microphotometric records are reproduced for three glasses. W. R. A.

Raman spectra of aliphatic hydrocarbons. G. B. BONINO and R. MANZONI-ANSIDEI (Proc. Indian Acad. Sci., 1938, **8**, A, 405—418).—Raman spectra are recorded, compared, and discussed for the following hydrocarbons: n-C_6H_{14}, n-C_7H_{16}, n-C_8H_{18}, β-methylhexane, γ-methylheptane, ββ-, βγ-, βδ-, and γγ-dimethylpentane, βγ-, βε-, and βδ-dimethylhexane, γ-methyl-γ-ethylpentane, ββγ-trimethylbutane, and ββγ- and ββδ-trimethylpentane.

W. R. A.

Raman and infra-red absorption spectra of compounds containing 4-co-ordinate nitrogen. (MME.) M. FREYMANN (Proc. Indian Acad. Sci., 1938, **8**, A, 301—308).—The Raman spectra and the absorption spectra in the near infra-red (0·8 to 1·2 μ.) of some NH_4 salts, amine hydrochlorides, NH_2-acids, and the complex Co, Cu, and Pt ammines have been examined. In agreement with previous observations (cf. A., 1937, I, 344) for dil. aq. solutions, the νν characteristic of NH are absent or very weak. For both fused NH_4NO_3 (160°) and its conc. aq. solution a broad band is observed in the infra-red absorption spectra at ~1·06 μ., which disappears rapidly when the aq. solution is diluted. W. R. A.

Raman effect and the structure of compounds AX_5. Phosphorus pentachloride and its homologues. H. MOUREU, M. MAGAT, and G. WETROFF (Proc. Indian Acad. Sci., 1938, **8**, A, 356—364).—An extension of work already noted (cf. A., 1937, I, 496). W. R. A.

Application of the new analysis of molecular spectra to some interesting molecules. II. DESLANDRES (Compt. rend., 1938, **207**, 1341—1345; cf. A., 1939, I, 6).—An analysis of Raman spectra of $CHCl_3$, NH_4Cl, $K_4Fe(CN)_6,3H_2O$, $K_3Cu(CN)_4$, and $KAg(CN)_2$ is discussed with reference to electron excitation in the mols. A. J. E. W.

Raman spectra and molecular configurations of solid ethylene dihalides. S. MIZUSHIMA and Y. MORENO (Proc. Indian Acad. Sci., 1938, **8**, A, 315—322).—The Raman spectra of $(CH_2Cl)_2$ at —140°, —40°, and in the liquid state, of $(CH_2Br)_2$ at —40°, 0°, and in the liquid state, and of $(CD_2Br)_2$ have been determined. $(CH_2Cl)_2$ has a thermal transition at —65° and $(CH_2Br)_2$ has one at —24° (A., 1937, I, 499). $(CD_2Br)_2$ was prepared by the following process: $CaC_2 + 2D_2O = C_2D_2 + Ca(OD)_2$; $4D_2O + 5Br + P = D_3PO_4 + 5DBr$; $C_2D_2 + 2DBr \rightarrow (CD_2Br)_2$. The *trans* state of these mols. has sym-

metry C_{2h} and in the solid state the mols. are predominantly in this configuration. Lines of low frequency, having different vals. above and below the transition point, are attributed to motion of the mol. as a whole in the crystal lattice. If the thermal transitions are due to mol. rotation it must take place about the zig-zag X·C·C·X chain in keeping with the estimated low heat of transition. W. R. A.

Raman effect and chemical constitution. Influence of constitutive and other factors on the double bonds in organic compounds. I. Coumarin. G. V. L. N. MURTI and T. R. SESHADRI (Proc. Indian Acad. Sci., 1938, **8**, A, 519—523).—The Raman spectrum of coumarin in CS_2, C_6H_6, $CHCl_3$, CCl_4, $COMe_2$, MeOH, and in the solid state has been investigated. νν, attributed to C:C, are uninfluenced by different solvents or by change of state. The C:O frequency occurs at ~1740 cm.$^{-1}$ in the non-polar solvents and in $COMe_2$, at ~1720 cm.$^{-1}$ in $CHCl_3$ and MeOH, and as a doublet, 1708 and 1731 cm.$^{-1}$, in the solid state. The splitting appears to be due to intermol. effects. W. R. A.

Raman effect. LXXXIX. Ethylene oxide. K. W. F. KOHLRAUSCH and A. W. REITZ. **XC.** *para*-**Substituted acetophenone.** L. KAHOVEC and J. WAGNER. **XCI. Asymmetric phthalyl chloride.** L. KAHOVEC. **XCII. Dimeric keten.** K. W. F. KOHLRAUSCH and R. SKRABAL. **XCIII.** *cyclo***Butane-1 : 2-dicarboxylic acid and derivatives.** K. W. F. KOHLRAUSCH and R. SABATHY. **XCIV. Tetrolic acid and its esters.** O. BALLAUS. **XCV. Nitrogen compounds. XII. (Nitrogroup).** E. PENDL, A. W. REITZ, and R. SABATHY (Proc. Indian Acad. Sci., 1938, **8**, A, 255—266, 323—329, 330—332, 424—435, 436—441, 483—486, 508—518).—The Raman lines of $(CH_2)_2O$ and their depolarisation factors have been measured. Selection rules, vibration forms, and spectroscopic activities of $(CH_2)_2O$ and *cyclo*propane are given. The assignments of observed νν are discussed.

XC. Raman νν for $X·C_6H_4·CO·Me$ (X = NH_2, OH, OMe, Me, Cl, Br) are recorded and discussed.

XCI. Phthalyl chloride can exist in a symmetric form, $C_6H_4(COCl)_2$ (I) or an asymmetric form, $C_6H_4{<}^{CO·}_{CCl_2}{>}O$ (II). The Raman spectra of liquid (I), of a molten mixture of (I) and (II), and of cryst. (II) have been determined and are discussed with special reference to the displacement 1736, 1791, and 1845 cm.$^{-1}$

XCII. The Raman spectrum of dimeric keten has been investigated. The selection rules, vibration forms, and spectroscopic activities are given for the diketo-form of the mol. (I) (*cyclo*butane-1 : 3-dione) and for *cyclo*-butane and -butanone. The observed spectrum is in accord with that predicted for (I). This is contrary to the conclusions of Angus *et al.* (A., 1936, 191) from dipole moment and other physical measurements that dimeric keten is predominantly in the keto–enol form. νν for 2 : 2·4 : 4-tetramethyl*cyclo*butane-1 : 3-dione and $CO(CMe_2·CO)_2O$ are recorded.

XCIII. Raman νν are recorded and discussed for *cis*- and *trans*-*cyclo*butane-1 : 2-dicarboxylic acids, their Me_2 and Et_2 esters, the anhydride of the *cis*-acid.

and the diamide of the *trans*-acid. Unlike analogous derivatives of *cyclo*-propane and -pentane, there is no marked difference between the spectra of the acids and their esters. Corresponding *cis*- and *trans*-derivatives have essentially similar spectra.

XCIV. Raman ꜹ for cryst. tetrolic acid, its aq. solution, and its Me and Et esters are recorded and compared with vals. for propolic acid and its corresponding derivatives.

XCV. Raman ꜹ are recorded for $MeNO_2$, $Pr^\beta NO_2$, $Bu^\beta NO_2$, *sec.*-$BuNO_2$, and $CCl_3 \cdot NO_2$. Depolarisation factors for $MeNO_2$ and $CCl_3 \cdot NO_2$ have been measured. Selection rules and vibration forms for possible models of $MeNO_2$ are considered and the planar C_{2v} symmetry is favoured. The doubling of the frequency 1380 cm.$^{-1}$ is discussed. The assumption that the NO_2 group may assume two different forms cannot be excluded.   W. R. A.

Molecular association in fatty acids. P. KOTESWARAM (J. Chem. Physics, 1939, **7**, 88).—For HCO_2H, AcOH, and BzOH the Raman ꜹ of the C:O band shift to higher frequencies as the acid is diluted with H_2O or heated. Dilution in C_6H_6 or in CCl_4 has no effect. This shifting of ꜹ is attributed to an increased amount of lower polymerised forms at higher dilution and temp.   W. R. A.

Raman spectra of *cis*- and *trans*-α- and -β-decalones. (MLLE.) D. BIQUARD (Compt. rend., 1938, **207**, 1415—1416).—The spectra are recorded, and the C:O linking ꜹ (1708—1714 cm.$^{-1}$) are deduced. Distillation of *cis*-α-decalone at atm. pressure does not give the *trans*-α-form.   A. J. E. W.

Raman spectra of terpenes. W. R. ANGUS (Proc. Indian Acad. Sci., 1938, **8**, A, 528—565).—The recorded Raman spectral data on terpenic compounds are tabulated and reviewed. The application of the Raman effect to the identification and estimation of the constituents of terpenic mixtures is criticised.   W. R. A.

Fluorescence and chemical constitution. O. MUMM (Ber., 1939, **72**, [*B*], 29—35).—Fluorescence originates in a mesomeric system. When light is absorbed this takes up one of the limiting structures, and can then pass over to the other limiting structure with radiation of light of longer λ. The theory is illustrated by reference to α-pyridones and α- and γ-dihydropyridines and related compounds, and also to $Pt(CN)_2$ and the uranyl salts.   F. J. G.

Ratio of primary to secondary light emitted in fluorescent discharge tubes containing neon. H. G. JENKINS and J. N. BOWTELL (Trans. Faraday Soc., 1938, **35**, 154—161).—Measurements have been made of the variation of the ratio of fluorescent light to Ne light as a function of pressure, c.d., and tube diameter, in Ne discharge tubes coated internally for a length of 30 cm. with Zn orthosilicate. For the current range 10 to 120 ma., the Ne light output is approx. ∝ current, whilst the fluorescent light output reaches a definite saturation intensity dependent on the gas pressure as the current is increased. The rapid increase in the ratio of primary to secondary light at low currents is readily explained on the assumption that resonance radiation is the main cause of the fluorescence, as the smaller ionic concn. at low currents lessens the probability of cumulative excitation and ionisation occurring, thus increasing the probability of resonance transitions.   W. R. A.

Luminescence of oxides under flame excitation. L. T. MINCHIN (Trans. Faraday Soc., 1938, **35**, 163—170).—A general review.   W. R. A.

Luminescence of sodium vapour in highly dilute flames. M. G. EVANS and M. POLANYI (Trans. Faraday Soc., 1938, **35**, 178—185).—Theoretical.   W. R. A.

Luminescence in solids. F. H. SPEDDING (Trans. Faraday Soc., 1938, **35**, 65—69).—A general review.   W. R. A.

Luminescence in solids. R. W. GURNEY and N. F. MOTT (Trans. Faraday Soc., 1939, **35**, 69—73).—When a non-metallic crystal absorbs light of sufficient energy an electron may be raised into the " conduction band " of the solid (cf. A., 1938, I, 499) and moved right away from its original position, *i.e.*, a free electron and a " positive hole " are created. The absorption spectrum of an atom or an ion in a crystal may or may not be similar to that of a free atom or ion. After an electron has been raised to an excited state, (i) it may fall back to its ground state with the emission of radiation, (ii) it may fall back with the emission of heat, or (iii) the heat motion of the surrounding atoms may remove the electron to the " conduction band " before (i) or (ii) have had time to occur. These three possibilities are discussed. In most phosphors the emission bands lie on the long-λ side of the absorption bands and this is explained. The efficiency of phosphors is considered.   W. R. A.

Interpretation of crystal luminescence. F. SEITZ (Trans. Faraday Soc., 1938, **35**, 74—85).—Tl-activated alkali halide phosphors behave as though they contained a dil. gas of Tl ions, mostly monat. but containing a small fraction of diat. mols. Fluorescent light is then produced by a process analogous to the resonance excitation of monat. gases. Absorbed and emitted ꜹ differ, however, as part of the excitation energy is given up to the lattice as vibrational energy. Phosphorescence occurs when the diat. mols. are excited and become trapped in a metastable state from which they may be released by thermal or infra-red excitation. In the ZnS phosphors the luminescent centres are the atoms occupying positions in the interstices of the ZnS lattice. These may be Zn atoms (in the case of heated specimens of ZnS) or Cu atoms (in Cu-activated ZnS). The mechanism by which phosphors are excited by cathode rays is discussed.   W. R. A.

Differential action of nickel, iron, and cobalt on the fluorescence and phosphorescence of certain zinc sulphide phosphors when excited by *X*-rays. L. LEVY and D. W. WEST (Trans. Faraday Soc., 1939, **35**, 128—134).—ZnS phosphors fluoresce more brilliantly under *X*-rays than any other type of phosphor or fluorescent substance but the fluorescence is always associated with excessive phosphorescence. Addition of Ni reduces this phosphorescence very greatly whilst the reduction of fluorescence is inappreciable. About 1 part in

2×10^6 of the Ni metal added to the phosphor (ZnS + 1 part in 20,000 of Ag) is the optimum concn. The same concn. of Fe has no effect on fluorescence or phosphorescence but if [Fe] is 10^{-6} the intensity of fluorescence is depressed and the intensity of phosphorescence is unaltered. Traces of Co diminish fluorescence intensity and, like traces of Ni, change the spectral characteristics of the phosphorescence. W. R. A.

Luminescence of inorganic salts. J. EWLES (Trans. Faraday Soc., 1938, **35**, 119—127).—The cathodo-luminescent spectra of 14 different samples of CaO have been examined, one sample being spectroscopically pure and the others each containing a trace of a different metal. The ultra-violet regions are resolvable and suggest that the emission is characteristic of the CaO, because const. ν intervals appear with vals. $\sim$ those of the vibration $\nu\nu$ of the crystal. Similar conclusions are drawn from the spectra obtained by ultra-violet irradiation of CaO. In the visible region the position of the broad unresolved bands is common to different samples and the rôle of the metal impurity appears to be merely to determine their relative intensities. Results similar to these have been obtained with ultra-violet-irradiated SrO. The data are discussed in relation to the questions of short-duration phosphorescence and of fluorescence. W. R. A.

Fluorescence of solutions of salts of cerium. A. N. FILIPPOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 351—353).—The fluorescence spectrum of Ce^{III} solutions exhibits a broad band between 313 and 407 mμ. The fluorescence is best observed by using dil. solutions and the light from an Fe spark. F. J. G.

Application of phosphorescence spectra to the investigation of the structure of solids and solutions. R. TOMASCHEK (Trans. Faraday Soc., 1939, **35**, 148—154).—Besides the elements Cr, Ni, and Co, the ions of Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, and Tm retain the sharpness of their spectra in the interior of solids and partly also in liquid solutions. By embedding salts of these elements in transparent substances and subsequently exciting fluorescence or phosphorescence by light or cathode rays the sharpness of the spectral lines can be used to study the effects of surrounding mol. force fields on the ions. This, the method of line fluorescence, has been applied to investigate the structure of glasses, the nature of phosphorescence centres in glass, the hyperstructure of cryst. substances, and the constitution of liquid solutions. The glass state, which is characterised by a particular type of spectrum, does not lie between the states of a solid and a liquid, but is a state of special structure. W. R. A.

Fluorescence of solids. E. J. BOWEN (Nature, 1938, **142**, 1081).—Solid anthracene (I) fluoresces blue with a high efficiency, the absorption band lying at $\lambda\lambda$ <3800 A. Solid $C_{10}H_8$ (II) fluoresces faintly, whilst solid pentacene (III) does not fluoresce appreciably. In dil. solid solution in (I), (II) and (III) fluoresce vividly with a greenish-yellow and a red fluorescence, respectively. This fluorescence is stimulated by light absorbed by the (I), the blue fluorescence of which is almost entirely suppressed. L. S. T.

Directional vibrations in the absorption and the fluorescence of the chrysene molecule. K. S. KRISHNAN and P. K. SESHAN (Proc. Indian Acad. Sci., 1938, **8**, A, 487—498).—Single crystals of chrysene are monoclinic and take the form of a flake parallel to (001). The mol. planes are at 79° with (001), and their intersections with (001) make angles of $\pm \phi$ with the b axis, where $\phi = 29\cdot5°$. A single crystal, excited by 3650 A. of Hg, incident normally, gave 3 diffuse fluorescence bands in the visible region, with max. at 4490, 4380, and 4200 A., which were polarised to approx. the same extent. Whether the incident vibrations are along a or b, the ratio (I) of the intensities of the a vibrations in the forward fluorescence to those of the b vibrations is 0·40, which $\sim \tan^2 \phi$. The same val. is obtained also when the incident light is unpolarised. The constancy of I indicates that when the incident light-vibrations are perpendicular to the plane of the mol. hardly any fluorescence is excited, and it is only vibrations in the plane that excite fluorescence. With a crystal thick enough to absorb completely the exciting radiation, the intensities of forward fluorescence excited by the a and the b vibrations separately are $\sim$ equal. Thus when the incident light-vibrations are perpendicular to the mol. plane there is little absorption; only vibrations in the plane are absorbed. W. R. A.

Fluorescence in solution. E. J. BOWEN (Trans. Faraday Soc., 1939, **35**, 15—21).—Present knowledge on the influence of the nature of the fluorescent substance, the solvent, the concn., the presence of " quenchers," and the temp. on the fluorescence efficiency of a solution is reviewed. Sp. quenching appears as a chemical reaction of a special and extreme type. Neither the simple collisional theory of reaction rates nor the " transition state " method is applicable. W. R. A.

Quenching of fluorescence in solution. E. J. BOWEN and A. NORTON (Trans. Faraday Soc., 1939, **35**, 44—48).—Preliminary results on the fluorescence of solutions of anthracene (I), 2 : 3-benzanthracene, 2 : 3 : 6 : 7-dibenzanthracene, and 5 : 6 : 11 : 12-tetraphenylnaphthacene are discussed. The fluorescence efficiency of (I) in ten solvents, the quenching by O_2, the influence of concn. of (I) in five solvents, and the effect of temp. have been measured. Limiting efficiencies for all except halogenated solvents are $\sim$ 0·2—0·3. The consts. for 15 different quenchers have been determined. Most of the quenchers react photochemically with (I). W. R. A.

Fluorescence of organic compounds in solution. P. PRINGSHEIM (Trans. Faraday Soc., 1938, **35**, 28—33).—Three aspects of the fluorescence of org. compounds are considered : (i) the variation of the power of fluorescence resulting from the introduction of certain substituents into dyestuff mols. in solution, (ii) the change of the power of fluorescence of the mol. in the ionised and neutral states, and (iii) the quenching of fluorescence by increase of concn. in solution. The existing hypotheses pertaining to these phenomena are discussed. W. R. A.

Polarisation of the fluorescence of dyes dissolved in mesophases. H. ZOCHER (Trans. Faraday Soc., 1938, 35, 34—37).—The polarisation of fluorescence of dyes has been produced by an asymmetric excitation of the mols. in anisotropic media, of which the smectic NH_4 oleate is most convenient. Most fluorescing dyes show a negative dichroism and a negative bifluorescence, but those derived from dehydrothiotoluidine show a positive dichroism. Positive bifluorescence is observed only for chlorophyll and hæmatoporphyrin, which show positive dichroism for long λλ and negative dichroism for short λλ.

<div align="right">W. R. A.</div>

Influence of temperature on extinction of phosphors. V. ANTONOV-ROMANOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 361—364).—The hypothesis that the temp.-dependence of the extinction of phosphors at low and moderate temp. is due solely to variation of the magnitude $\omega_T = e^{-\epsilon/kT}$ where ω_T is the probability of an electron being free is considered and compared with observed results.

<div align="right">F. J. G.</div>

Recent experiments in luminescence. J. T. RANDALL (Trans. Faraday Soc., 1938, 35, 2—14).—The sharpness of the bands or lines of partly resolved fluorescent spectra of solids is greatly increased by measurements at low temp. Low-temp. investigation, further, has revealed the existence of new fluorescent substances which are not fluorescent at ordinary temp. The mechanism of fluorescence of a no. of substances is considered.   W. R. A.

Blackening of zinc [and cadmium] sulphide phosphors. N. T. GORDON, F. SEITZ, and F. QUINLAN (J. Chem. Physics, 1939, 7, 4—7).—The blackening of ZnS and CdS phosphors is a two-quantum process in which both positive and negative charges, released from the interior, move to the surface and produce electrolysis in a film of moisture which is present when the surface is in damp air. This theory explains satisfactorily all the known data on blackening. The differences between this effect and the print-out effect in photographic emulsions are discussed.   W. R. A.

Absorption spectrum of luminescent zinc sulphide and zinc–cadmium sulphide in connexion with some optical, electrical, and chemical properties. J. H. GISOLF (Physica, 1939, 6, 84—96).—The absorption of ZnS, either pure or activated with Cu or Ag, begins in the violet and increases sharply to a high val. at λ 335 mμ. This λ is independent of the cryst. structure. Admixture of CdS displaces the absorption to longer λλ, and activation with Mn has a smaller, similar effect. The λ separating the regions of short-lived (<1 sec.) and long-lived (≫1 sec.) afterglow is identical with the boundary of intense absorption. This boundary also corresponds with the short-λ limit of photoconductivity' and the long-λ limit of photochemical blackening.   L. J. J.

New results with luminescent zinc sulphide and other luminous substances. N. RIEHL (Trans. Faraday Soc., 1938, 35, 135—140).—A discussion of recent experimental and theoretical results on fluorescent substances with special reference to fluorescent ZnS.   W. R. A.

Sulphide phosphors and the zone theory of solids. C. J. MILNER (Trans. Faraday Soc., 1939, 35, 101—111).—The zone theory of solids has been applied to explain many of the principal features of the luminescence of sulphide and allied phosphors, e.g., the division of crystals into those which are luminescent in the pure state and those requiring "activation," the "momentan-" and the "dauer-" processes of excitation and characteristic bands, the existence of two definite band widths for all activators in a given phosphor, the absence of prolonged phosphorescence in certain phosphors and its presence in others, the existence of two peaks in the emission spectrum excited by different absorption regions, and the asymmetry and temp.-dependence of the widths of these peaks. The results of Riehl (A., 1937, I, 444) on ZnS have been interpreted on the basis of the zone theory.   W. R. A.

Beginning and cessation of the light process in phosphors. I. A. SCHLEEDE and B. BARTELS (Physikal. Z., 1938, 39, 936—940).—The luminescent properties of ZnO, ZnS, ZnS–CdS activated by Ag, and Zn_2SiO_4 activated by Mn, and $CaWO_4$ are considered, and, in particular, the way in which they respond to ultra-violet and electron (1·5 and 25 kv.) excitation. The phosphors were excited for short periods (10^{-5}, 4×10^{-3}, and 0·2 sec.) by rectangular impulses, and the form of the light impulse given by the phosphor was determined by a photo-electric cell. It was found that the starting and stopping processes correspond with each other, and that the form of the emission curve is dependent on excitation intensity.

<div align="right">A. J. M.</div>

Practical applications of luminescent solids. L. J. DAVIES (Trans. Faraday Soc., 1939, 35, 171—177).—Practical applications fall into three categories : (a) those in which the luminescent material acts as, or supplements, the light source, (b) those in which it is the object viewed, and (c) those in which the quality and quantity of luminescence are not of intrinsic importance but are taken to indicate the presence or absence of other properties. The excitation of luminescence for (a) by high-pressure Hg-vapour lamps is discussed. The high temp. at which the lamp is operated renders it impossible to deposit luminescent powders on the tube itself, but they may be applied to the inner surface of the outer jacket of the lamp. The requirements of such a powder are considered, but up to the present no powder fulfilling all the requirements has been found. With low-pressure Hg-vapour lamps the temp. is sufficiently low to allow luminescent powders to be applied to the tube itself and several powders of the Zn silicate type are excited to luminescence by it. The use of such systems for domestic and public lighting is discussed with particular reference to the rendering of colours. The main features of the other two categories are reviewed. A luminescent solid should have high efficiency, controlled after-glow, be sensitive to short- and long-λ ultra-violet and to electron bombardment; it should be stable to, and maintain its efficiency at, high temp. The effects of the material by which the luminescent powder is

affixed to the surfaces on which it will be used must be included in any study of such a powder.   W. R. A.

Excitation of phosphors by collisions of the second kind. K. SOMMERMEYER (Z. physikal. Chem., 1938, **B, 41**, 433—440).—Luminescence is excited on a Zn silicate phosphor by the surface recombination of H atoms or N atoms. For H the quantum yield is ~0.5×10^{-5} light quanta per recombination. The mechanism of the process is discussed.   J. W. S.

Phosphorescent glasses. Decay of phosphorescence. M. CURIE (Trans. Faraday Soc., 1938, **35**, 114—118).—Using various luminogens, including Mn and Sm, the intensity and duration of luminescence have been investigated in Zn borate in ordinary glass, in both the vitreous and cryst. states. Crystallisation lengthens the duration, and, for Mn, an intensification of luminescence on crystallisation is observed. The latter result is discussed in relation to existing theories of luminescence. When the crystallising fusion of borate (Mn as luminogen) is carried out in O_2 a green luminescent product is obtained, whilst in a non-oxidising atm. the luminescence is orange. The rate of decay of both products follows the law $I = At^{-a}$, the green being more persistent than the orange. The mechanism of phosphorescence and the laws of phosphorescent decay are considered.   W. R. A.

Oxidation and chemiluminescence. J. WEISS (Trans. Faraday Soc., 1939, **35**, 219—224).—In those reactions in solution for which chemiluminescence arises through recombination between atoms or radicals, or in an electron transfer process between radicals or ions, the condition for chemiluminescence is given in terms of the crossing of the potential curves. The probability of chemiluminescence can be estimated. The theoretical considerations have been applied to several oxidation reactions, e.g., the alkaline oxidation of lophine and amarine, and the oxidation of CH_2O, of pyrogallol, and of luciferin.   W. R. A.

Photo-luminescence and vibrational energy exchange in complex molecules. A. TERENIN, A. VARTANIAN, and B. NEPORENT (Trans. Faraday Soc., 1938, **35**, 39—43).—The photo-luminescence of NH_2Ph vapour has been investigated. At low pressure and ordinary temp. a "resonance" progression of sharp bands, due entirely to electronic transition, is observed when the monochromatic excitation is confined to the beginning of the absorption spectrum. This gives place to the usual continuous spectrum when the excitation shifts up the absorption spectrum. Probably this is due to a complicated unresolved vibrational–rotational structure produced by a high content of vibrational energy in the lower electronic state. The effect of foreign gas (H_2, N_2, CO, O_2, NH_3, and cyclohexane) admixture (max. pressure 400 mm.) has been studied. O_2 is unique in that it strongly quenches the continuum and the "resonance" bands without adding new ones, proving that a chemical reaction proceeds between the O_2 and the NH_2Ph. The enhancement of the fluorescence excited in the zone 2778—2500 A. caused by foreign gas admixture has been measured and theoretically analysed. Heating of the vapour to 350° quenches

K (A., I.)

the normal fluorescence spectrum at the lowest pressure due to a photo-thermal unimol. dissociation of the mol. with rupture of the C·N and C·H bonds.   W. R. A.

Relationship of fluorescence to photolysis in gaseous systems. R. G. W. NORRISH (Trans. Faraday Soc., 1938, **35**, 21—28).—A discussion of existing data.   W. R. A.

Quenching of luminescence by oxygen. H. KAUTSKY (Trans. Faraday Soc., 1939, **35**, 216—219).—Dyes, such as trypaflavin, chlorophyll, and porphyrins, adsorbed on SiO_2 or Al_2O_3 gel, are fixed firmly but are still accessible to all mols. diffusing to them; after evacuation they fluoresce, and some phosphoresce also. O_2 quenches both fluorescence and phosphorescence, but whereas the quenching of fluorescence depends on the pressure of O_2, phosphorescence is completely quenched by ~10^{-3} mm. O_2. The process underlying the quenching of fluorescence by O_2 and the connexion between this process and photo-oxidation sensitised by fluorescent dyes are discussed.   W. R. A.

Chemiluminescence of sodium vapour with organic halides. C. E. H. BAWN and W. J. DUNNING (Trans. Faraday Soc., 1938, **35**, 185—190).—In agreement with the previous observation on trimethylene bromide (cf. A., 1938, II, 253), all saturated org. dihalides so far examined emit an intense yellow luminescence in the reaction with Na vapour which corresponds with the Na-D line. The reaction proceeds in two stages, $RHI_2 + Na \rightarrow -RHI + NaHI$ (i) and $-RHI + Na \rightarrow (R) + NaHI$ (ii), of which (ii) is the light-producing reaction. (R) is a biradical, unsaturated mol., or cyclic compound. Thermal calculations indicate that for luminescence (R) must be an unsaturated mol., formed by closure of a double bond (I), or by migration of a H atom (II), or (III) a cyclic mol. The data on 15 compounds show that the light yield of reactions (II) is $\ll$ those of reactions (I) and (III). The reactions with methylene halides, ethylene dibromides, ethylidene dibromide, and the dihalides of C_3H_8, n-C_4H_{10}, and iso-C_4H_{10} are discussed.   W. R. A.

Chemiluminescence in the oxidation of certain organic substances. H. D. K. DREW (Trans. Faraday Soc., 1938, **35**, 207—215).—The data accumulated on the chemiluminescent reactions of the Grignard reagents (I), the NN'-dimethyldiacridylium salts (II), and the phthaliccyclohydrazides (III) are reviewed and examined for possible mechanisms of the chemiluminescence. Nothing conclusive can be derived from (I), but it is possible that with aromatic Grignard reagents an initial addition of O_2 occurs at the C atom directly attached to the metal atom, followed by a migration of the metal to the O. The oxidation and reduction of (II) leads to a probable explanation of the luminescence in which the carbinol base is regarded as oxidised by H_2O_2 to the peroxide, which is then reduced by H_2O_2 back to the carbinol base, the light emission occurring during the reaction. In the luminescence of (III) an essential structural feature is the cyclohydrazide ring. Various mechanisms are discussed but no definite conclusion is reached.   W. R. A.

Mechanism of the chemiluminescence of 3-aminophthalhydrazide. I. B. J. Sveshnikov (J. Phys. Chem. Russ., 1938, **11**, 720—732).—The luminescence of alkaline mixtures of H_2O_2 and 3-aminophthalhydrazide (I) is at 18° measurable for days, and at 52° for hours; its intensity decreases at first slowly and then rapidly. It decreases slightly with rising concn. of (I), reaching a max. in 0·5% NaOH and when the ratio [NaOH] : [H_2O_2] is approx. 50—100. Some (I) is used up in the course of luminescence. A short luminescence is observed when acid is added to an alkaline, or alkali to an acid, solution of (I). This luminescence is presumably due to hydrolysis of (I), and that in presence of H_2O_2 to an oxidation of hydrolysis products.   J. J. B.

Electro-photo-luminescence. G. Destriau (Trans. Faraday Soc., 1938, **35**, 227—233).—An extension of work already noted (cf. A., 1937, I, 283, 550, 895).   W. R. A.

Two examples of the non-additivity of the photo-electric effects of simultaneous luminous fluxes. G. Liandrat (Compt. rend., 1938, **207**, 1396—1397).—Non-addivity effects with Thalofide and Se cells are described.   A. J. E. W.

External photo-electric effect of semi-conductors. E. U. Condon (Physical Rev., 1938, [ii], **54**, 1089—1091).—Anomalies obtained in Millikan's early work on Cu_2O and described as spurious contact p.d. can be explained on present theory, and an analysis of the effect of contact potentials on photo-electric measurements with semi-conductors indicate a new method of determining the width of the forbidden energy interval for electrons in a semi-conductor. A possible application to precision determination of h/e by the photo-electric effect is indicated.   N. M. B.

Method of action of composite photo-cathodes. H. Teichmann (Physikal. Z., 1938, **39**, 914—916).—The theory that the intermediate layer of a composite photo-cathode behaves like an electronic semi-conductor, so that between the individual layers of the cathode semi-conductor photo-effects are obtained, is confirmed by experiments with K–Se–Fe, Cs–Cs_2O–Ag, and K–(K_2O)Al_2O_3–Al cathodes. The position and intensity of the max. of the efficiency curves of the last two cathodes were determined.   A. J. M.

Behaviour of composite photo-cathodes of potassium, rubidium, and cæsium in the ultra-violet. W. Kluge (Physikal. Z., 1938, **39**, 911—914).—The relative spectral efficiency curves of Ag–K_2O–K, Ag–Rb_2O–Rb, and Ag–Cs_2O–Cs composite photo-cathodes has been determined over the λ range 200—450 mμ. No normal photo-effect is found at λ <300 mμ., but the efficiency curves show a band-like structure. It is supposed that these bands are the absorption spectrum of the alkali oxide used, the lattice of the oxide being distorted by alkali metal and Ag atoms.   A. J. M.

Photo-electric excitation of composite photo-cathodes at low temperatures. R. Suhrmann and A. Mittmann (Z. Physik, 1938, **111**, 137—151; cf. A., 1939, I, 9).—The photo-electric sensitivity of

K–KH–K, Na–NaH–Na, and Cs–$C_{10}H_8$ cathodes at 83° and 20° K. and at $\lambda\lambda$ corresponding with their spectral sensitivity max. decreases under continued irradiation with light of that λ. Irradiation with light of longer λ (yellow, red, and infra-red) causes a rapid return to normal sensitivity. Cathodes desensitised in this way also become activated by developing a spectral sensitivity max. in the infra-red; this is attributed to an absorption band of the excited centres.   H. C. G.

Rectification of the current at the boundary between two semi-conductors. B. Davidov (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 279—282).—Theoretical.   O. D. S.

Theory of solid rectifiers. B. Davidov (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 283—285).—It is suggested that rectification in solid Cu_2O occurs at a boundary between Cu_2O and a layer (deposited near the Cu electrode) of Cu_2O saturated with Cu. Application of the author's theory (cf. preceding abstract) gives vals. for the rectifying action of the order of magnitude of experimental vals.
    O. D. S.

Distribution of an electron stream with a three-electrode crystal, and a model of a barrier layer. R. Hilsch and R. W. Pohl (Z. Physik, 1938, **111**, 399—408).—Electronic conductivity in KBr crystals is discussed generally. The nature of a limiting layer is illustrated by a piece of Pt foil extending across one face of the crystal. The rectifying action of the crystals with different electrode arrangements is compared with that of the Cu–Cu_2O rectifier.
    H. C. G.

Dipole moment of a free molecule from data of the pure dipole liquid. C. J. F. Böttcher (Physica, 1939, **6**, 59—81; cf. A., 1938, 436).—Vals. for μ calc. from ϵ and n by means of Onsager's formula (A., 1936, 1182) are nearly independent of temp. and in good agreement with vals. from vapour and dil. solution measurements for a no. of NO_2-compounds, ketones, org. bases, nitriles, halogen compounds, etc. Anomalous vals. are given by compounds subject to association (AcOH, H_2O, EtOH) and mechanical interaction [Et_2O, PhOMe, $(CH_2Cl)_2$].
    L. J. J.

Effect of intermolecular action on dielectric polarisation. C. P. Smyth (J. Physical Chem., 1939, **43**, 131—142).—Theoretical. Dielectric polarisation vals. are examined in the light of theories of restricted mol. rotation as developed by Müller and by Onsager.   C. R. H.

Free rotation in complex dipolar ions in solution. J. Wyman, jun. (J. Physical Chem., 1939, **43**, 143—152).—Dielectric const., ϵ, data for lysyl-glutamic acid (I) are analysed in terms of free rotation. A general method is worked out for calculating the effects of free rotation in complex dipolar ions in terms of a dielectric increment, δ, expressed as the slope of the ϵ-concn. curve. For aliphatic NH_2-acids $\delta = 13\cdot2n - 3\cdot5$, and for the series comprising the glycine peptides $\delta = 15n - 7$, where n is the no. of valency linkings. In the case of (I), substitution of $n = 22$, corresponding with a dipolar ion, in the second expression gives $\delta = 323$ as compared with

the observed val. 345. This implies that the degree of free rotation in (I) is similar to that observed in other peptides and NH_2-acids.   C. R. H.

Relaxation and electrical phenomena. H. FALKENHAGEN (Physikal. Z., 1938, **39**, 806—815).—The connexion between the Debye relaxation time and the behaviour of dipole liquids towards electric waves is discussed, and the results of recent experiments are considered in the light of Debye's theory. The connexion between dielectric loss and the quasi-cryst. structure of liquids is considered, and the dielectric anomalies of solids are reviewed. Electrical relaxation is also considered in connexion with inhomogeneous dielectrics and strong electrolytes.   A. J. M.

Structure, relaxation, and dispersion in liquids. J. MALSCH (Physikal. Z., 1938, **39**, 840—845).—The importance of determinations of relaxation and dielectric dispersion of liquids for the investigation of the structure of liquids is pointed out. The determinations of the variation of dielectric saturation with temp. do not agree with the simple theory of polar liquids, but with the extended theory, taking into account the structure of liquids. The assumption of a relaxation time for the structure will explain Hackel's formula (A., 1937, I, 221). The investigation of complex mols. in the short-wave region is also referred to.   A. J. M.

Effect of molecular structure on dielectric relaxation. E. FISCHER (Physikal. Z., 1938, **39**, 845—848).—The dielectric loss of dil. solutions of mols. with polar groups capable of free rotation, and of those incapable of such rotation, has been determined and compared, in order to discover the connexion between the dielectric relaxation time and the structure of the polar mol. It is found that the results for mols. of various sizes and forms and with dipoles in different positions can be better expressed by the formula of Perrin, according to which the mols. are regarded as ellipsoidal, rather than by supposing them to be viscous spheres. The relaxation time for mols. with polar groups capable of free rotation is < that for mols. of equal size but with a fixed polar group. This can be explained by assuming that two frictional quantities came into play, one being characteristic of the rotation of the mol. as a whole, whilst the other is characteristic of the free rotating group.   A. J. M.

Electrical relaxation phenomena. E. PLÖTZE (Physikal. Z., 1938, **39**, 848—852).—Determinations of dielectric dispersion were carried out with dil. solutions of polar substances ($PhNO_2$, $C_5H_{11}·OH$) in non-polar oils. The results are in qual. agreement with Debye's theory.   A. J. M.

Action of light on thin metallic films. Q. MAJORANA (Atti R. Accad. Lincei, 1938, [vi], **28**, 132—136).—An apparatus is described by means of which a more detailed study can be made of the photo-resistance effect previously observed when intermittent light is allowed to fall on thin metallic films (cf. A., 1934, 353, 584).   O. J. W.

Action of intermittent light on thin films of gold. Q. MAJORANA (Atti R. Accad. Lincei, 1938, [vi], **28**, 137—142).—The photo-resistance effect has been confirmed by means of the apparatus described in the preceding abstract with thin films of Au deposited on glass. Measurements of the hysteresis between the illumination and resistance cycles for different thicknesses of film and different frequencies of interruption of the light source are recorded.   O. J. W.

Electronic conduction in insulating crystals under very high field strength. A. VON HIPPEL (Physical Rev., 1938, [ii], **54**, 1096—1102).—Curves for current–voltage and photo-electric response measured up to the breakdown point in single crystals of KCl, KBr, NaCl, Rbl, and mica are given. 10^7 v. per cm. were reached in mica, and phenomena were observed acoustically. The dark currents and photo-currents observed give information on the mechanism of electric conduction under very high field strength.   N. M. B.

Refraction and dispersion of HCl, HBr, and H_2S and the isotopic heavy molecules DCl, DBr, and D_2S. T. LARSÉN (Z. Physik, 1938, **111**, 391—398).—The dispersion is measured for these compounds from $\lambda = 5677·4$ A. up to the commencement of absorption in the ultra-violet. The heavy isotopes show a similar reduction in the abs. val. of n, and a flattening of the dispersion curves as is found in D_2 and CD_4.   L. G. G.

Refractive index and molecular refraction of methane and deuteromethane. O. E. FRIVOLD, O. HASSEL, and E. HETLAND (Physikal. Z., 1939, **40**, 29—32).—n and mol. refractions of CH_4 and CD_4 are recorded for a no. of λ between 4046·6 and 6562·9 A. Vals. for $(n-1) \times 10^6$ at these $\lambda\lambda$ are 452·87 and 439·42, and 446·27 and 433·33, for CH_4 and CD_4 respectively.   A. J. M.

Organic sulphides : specific gravities and refractive indices of aliphatic sulphides. G. W. AYERS, jun. and M. S. AGRUSS (J. Amer. Chem. Soc., 1939, **61**, 83—85).—Sp. gr. at 0°, 20°, and 25° and n_D at 20° and 25° are recorded for Et, Pr^α, Pr^β, Bu^α, Bu^β, n- and iso-amyl sulphides. Mol. refraction vals. have been calc.   E. S. H.

Faraday effect in heavy water. F. GABLER (Physikal. Z., 1939, **40**, 32—33).—The effect of temp. on the magnetic rotation of H_2O, D_2O, and mixtures of the two has been determined at λ 5461 and 5893 A. The Verdet const. V is connected with temp. θ by $V = a - b\theta - c\theta^2$. For D_2O at 20°, $V = 0·01483$ and 0·1254 min. per Gauss cm. at 5461 and 5893 A., respectively. The vals. for a mixture of 54·2% D_2O and 45·8% H_2O follow Schönrock's mixture rule. The results do not support the assumption that HOD mols. exist in the mixture.   A. J. M.

Inertia of the Kerr effect. O. MAERCKS and W. HANLE (Physikal. Z., 1938, **39**, 852—855).—A new method of determining the inertia of the Kerr effect, in which a stroboscopically illuminated ultrasonic wave is used as an analyser, is described. The relaxation times of $PhNO_2$, $C_8H_{17}·OH$, 1-$C_{10}H_7Br$, $NPhMe_2$, and $NPhEt_2$ are given. The disappearance of the Kerr

effect for $C_8H_{17}\cdot OH$ at λ 32 m. observed by Raman *et al.* (A., 1928, 688), could not be confirmed.

                            A. J. M.

Constitutional conditions for mesomerism. Stereomerism and mesomerism. F. ARNDT and B. EISTERT [with remarks by K. A. JENSEN] (Ber., 1939, 72, [*B*], 202—212).—The limiting formulæ of a mesomeric system may be such as to imply different spatial arrangements. In such cases it must be remembered that the limiting formulæ are purely fictitious, and that the actual spatial configuration will be defined by the mesomeric electron distribution. On the other hand an ion at the moment of formation must have the spatial configuration of the tautomeride from which it was formed, but will rapidly take up the stable intermediate configuration.   F. J. G.

Development of Werner's theory, as applied to complex compounds. I. I. TSCHERNIAEV (Sci. Mem. Univ. Leningrad, 1937, 3, No. 17, 181—188).— A review.   R. T.

Is there an essential difference between " ordinary " and " complex " compounds. III. J. ZERNIKE (Chem. Weekblad, 1939, 36, 24—27; cf. A., 1939 I, 79).—The electrical properties of the alkyl and aryl hydroxides of Hg, Tl, Sn, Pb, N, P, As, Sb, S, Te, I, and particularly Cr are discussed. Complex ions are formed when the no. of alkyl groups attached to the metal exceeds its H valency. Cr is univalent in the Cr–Ph compounds, the Ph groups being bound in a way intermediate between " hypercomplex " and " metallic."   S. C.

Long-range forces between hydrogen molecules. H. S. W. MASSEY and R. A. BUCKINGHAM (Proc. Roy. Irish Acad., 1938, 45, A, 31—45).— Theoretical van der Waals and quadripole interaction energies are calc. by variation and perturbation methods for large distances of separation R. The former method gives a val. $1 \cdot 52$ or $1 \cdot 43 \times 10^{-59} R^{-6}$ erg for the van der Waals interaction, in good agreement with that found by Lennard-Jones (A., 1931, 1358).   L. J. J.

Inequality concerning lattice sums. B. S. M. RAO and K. V. IYENGAR (Proc. Indian Acad. Sci., 1938, 8, A, 524—528).—Mathematical.   W. R. A.

Excitation of intramolecular vibrations by collision. A. EUCKEN and L. KÜCHLER (Physikal. Z., 1938, 39, 831—835).—The results of experiments on the dispersion of ultrasonic waves give the no. of collisions (Z) necessary for the transition of a vibrational quantum into translational energy, Cl_2, N_2O, and CO_2 being investigated at 20°. In all formerly investigated cases the dispersion curve is normal, indicating a single val. of Z. The variation of Z with temp. between 290° and 700° K. has been investigated for pure CO_2 and N_2O and for CO_2 mixed with other gases. For the pure gases Z falls rapidly with rising temp., but the effect is smaller for mixtures. For CO_2–H_2 mixtures the Z–temp. curve shows a min. The results of these experiments can be qualitatively explained from considerations of the form of the potential curve, making use of the analogy with predissociation phenomena.   A. J. M.

Calculation of effective ionic radii from mol. refraction of ions. E. KORDES (Naturwiss., 1939, 27, 30—31).—An empirical equation connecting the effective radii of ions with their mol. refraction is suggested for ions of the inert gas type, and another for those not of this type. The equations are independent of the state of aggregation of the substances. The calc. ionic radii agree well with those obtained by the empirical equation of Goldschmidt and those deduced theoretically by Pauling.   A. J. M.

Nature of lattice defects in silver bromide crystals. F. SEITZ (Physical Rev., 1938, [ii], 54, 1111—1112).—Characteristics of two types of defects are reviewed, and revised calculations for AgBr are discussed.   N. M. B.

Statistical mechanics of condensing systems. V. Two-component systems. J. E. MAYER (J. Physical Chem., 1939, 43, 71—95).—Mathematical.   C. R. H.

Hindered molecular rotation and the dielectric behaviour of condensed phases. A. H. WHITE (J. Chem. Physics, 1939, 7, 58—60).—A relation is derived mathematically between the polarisability of a liquid or of a collection of randomly oriented single crystals, in which polar mols. can rotate only between two extreme equilibrium positions, the angle separating these positions, the difference of potential existing between them, and the dipole moment. The difference between the derived equation and that for gases is discussed.   W. R. A.

A thermochemical constant and its relations with electronic energy values. M. BRUTZCUS (Compt. rend., 1938, 207, 1209—1211).—The energy vals. of a no. of linkings, and the energies required for valency augmentation in a no. of cases, are shown to be simple multiples of an approx. const. energy of 50—58 kg.-cal. This energy is considered to correspond with electron excitation from L to N, or from M to Q shells, requiring $57 \cdot 1$ and $27 \cdot 6$ kg.-cal. per g.-mol., respectively. Small deviations from the exact multiples are ascribed to vibration and rotation effects.   A. J. E. W.

Theory of structure and problems of the dynamics of organic molecules. A. E. FAVORSKI (Sci. Mem. Univ. Leningrad, 1937, 3, No. 17, 171—180).—Theoretical.   R. T.

Calculation of [spectroscopic characteristics of] certain molecules. O. BURKARD (Proc. Indian Acad. Sci., 1938, 8, A, 365—382).—The frequencies, vibration forms, and energy distributions for the plane vibrations have been calc. in terms of mass, valency angles, and force const. for the systems : 1 : 3 : 5-substituted C_6X_3, $CX_2:CX_2$, *cis-* and *trans-*CX:CX, and the phosgene type, COX_2.   W. R. A.

Characteristic vibrations of mechanical molecular models. IV. 4-Membered rings. F. TRENKLER (Proc. Indian Acad. Sci., 1938, 8, A, 383—392; cf. A., 1936, 782).—Experimental vibration forms and characteristic frequencies, obtained by reference to mechanical models of *cyclo*-butane, -butene, -butadiene, -butanone, and -butane-1 : 3-dione, are in fair

agreement with theoretical prediction. Deviations in the frequencies are due to deformation of the rings.
W. R. A.

Normal frequency of the diamond lattice. T. VENKATARAYUDU (Proc. Indian Acad. Sci., 1938, **8, A,** 349—352).—The proper basis of the diamond lattice consists of two atoms only, the positions of which, referred to rhombohedral axes, are respectively (0, 0, 0) and ($\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{4}$). Such a model has symmetry O_h. Application of group theory indicates that the diamond lattice has only one limiting mode of oscillation which is active in the Raman spectrum and inactive in infra-red absorption and is triply degenerate. In this mode the two interpenetrating lattices are oscillating against each other in an arbitrary direction. This agrees with the observed intense Raman displacement of 1332 cm.$^{-1}$ Other weak Raman lines and the infra-red absorption max. are regarded as secondary effects. W. R. A.

Relation between the force constant, the internuclear distance, and the dissociation energy of a diatomic linkage. G. B. B. M. SUTHERLAND (Proc. Indian Acad. Sci., 1938, **8, A,** 341—344).—A general mathematical treatment, based on the classical method of Newing (A., 1935, 685), indicates that the empirical Allen–Longair and Badger relations between the force const. characterising the vibration ν of a diat. linking and the internuclear distance of the two atoms need modification. A derived expression for the dissociation of a diat. linking gives results in agreement with experimental data. W. R. A.

Parachors of inorganic salts in solutions and their structure. II. Lithium, sodium, and rubidium salts and atomic parachors of the above elements including cæsium. J. V. LAKHANI and R. P. DAROGA (J. Indian Chem. Soc., 1938, **15,** 519—524).—The parachors of NaCl, NaBr, NaNO$_3$, Na$_2$S$_2$O$_3$, NaHSO$_3$, LiCl, LiBr, and RbCl have been determined by the solution method. The average val. for Na$_2$S$_2$O$_3$ is 316·6 and for NaHSO$_3$ 209·9. The vals. for the Li, Rb, and remaining Na salts are > the vals. obtained by the fusion method. The average vals. found are for Na, 90·06, Li 46·8, and Rb 141·62. A parabolic curve is obtained if the at. no. is plotted against the parachor consts. of the metals, and Sugden's val. for Cs, obtained by the fusion method, lies on the curve. C. R. H.

Surface tension of hydrocarbons. D. L. KATZ and W. SALTMAN (Ind. Eng. Chem. 1939, **31,** 91—94).—Data for the surface tension of C$_2$H$_6$, C$_3$H$_8$, and C$_4$H$_{10}$, in the range 0—45°, are presented, and are correlated with figures for n-paraffins, from the literature, by means of a general curve for surface tension as a function of reduced temp. The possibility of predicting crit. temp. from such a curve is discussed. T. C. G. T.

Scattering of X-rays by a system of rotating molecules. C. FINBAK (Physikal. Z., 1939, **40,** 26—28).—Theoretical. It is very probable that crystal lattices constructed of rotating mols. will give characteristic X-ray diagrams, and deviations from the normal diagrams would be expected particularly in the case of mols. with heavy atoms in the peripheral regions. A. J. M.

Graphical representation of the possibilities of axial combinations. H. TERTSCH (Z. Krist., 1938, **100,** 85—90).—Crystallo-mathematical. I. McA.

General graphical method for determining the spacings of lattice planes. M. A. PEACOCK (Z. Krist., 1938, **100,** 93—103).—The method, based on the geometry of the reciprocal lattice, and especially rapid for triclinic crystals, is exemplified with axinite (A., 1937, I, 430); error <1%. Procedures for higher symmetries, lattice centering, and space-group conditions are outlined. I. McA.

Classification of solids. W. NOWACKI (Z. Krist., 1938, **100,** 77—81; cf. Strock, A., 1936, 1325).—A classification based primarily on the no. (3, 2, 1, 0) of independent linear translations for representative points, with successive subdivisions dependent on the existence or not of open lattice spaces, at. group rotation, and identity in physico-chemically and structurally equiv. particles, is illustrated by examples. Detailed distinctions involving isotopes, excited atoms, and thermal vibrations are omitted. I. McA.

Crystal growth of sodium chloride. K. SPANGENBERG (Z. Krist., 1938, **100,** 82—85; cf. *ibid.*, 1927, **65,** 204).—Further goniometric measurements with improved apparatus are reported. I. McA.

Inorganic giant molecules. H. G. GRIMM (Naturwiss., 1939, **27,** 1—11).—The determination of the type of linking (ionic, metallic, intermol. or van der Waals, and homopolar) present in a crystal by projection of the electron density on to certain lattice planes is described, and the results obtained for NaCl, diamond, Mg, and (CH$_2$)$_6$N$_4$, taken as characteristic examples, are discussed. The type of binding present in inorg. giant mols. and the structure of silicates are dealt with. The effect of the type of binding on the practical use of crystals is illustrated by reference to the bindings present in the characteristic substances of Mohs' scale of hardness. A. J. M.

Orientation of surface crystals of brass by abrasion. N. A. SCHISCHAKOV and V. I. KASATOTSCHKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20,** 277).—Electron diffraction patterns show orientation in the surface layers of brass abraded in any definite direction. O. D. S.

Crystal structure of germanium nitride. R. JUZA and H. HAHN (Naturwiss., 1939, **27,** 32).—Ge$_3$N$_4$ is rhombohedral, $a = 8·56_5$ A., $\alpha = 107°$ 46'. It has the structure of phenacite, Be$_2$SiO$_4$. Each Ge is surrounded tetrahedrally by 4 N, and each three tetrahedra have one N in common. A. J. M.

X-Ray studies on magneto-plumbite, PbO,6Fe$_2$O$_3$, and other substances resembling " β-alumina," Na$_2$O,11Al$_2$O$_3$. V. ADELSKÖLD (Arkiv Kemi, Min., Geol., 1938, **12, A,** No. 29, 1—9).—X-Ray investigation of the products obtained by co-pptg. Pb$^{\cdot\cdot}$ and Fe$^{\cdot\cdot\cdot}$, in various proportions, with aq. NH$_3$ or (NH$_4$)$_2$CO$_3$ and igniting the mixture at 1000°, indicates the formation of the *compound* 5PbO,2Fe$_2$O$_5$ and of PbO,6Fe$_2$O$_3$ (I), the latter having a 5·877 A., c 23·02 A. Measurements on natural crystals of (I) indicate that the probable space-group is D_{6h}^4—$C6/mmc$, similar to that of " β-alumina."

The crystal structures of compounds of this type are discussed.   J. W. S.

Crystal structure of sodium bromate. J. E. HAMILTON (Z. Krist., 1938, **100**, 104—110).—Single-crystal X-ray analysis, using two-dimensional Fourier synthesis and photometered intensities, confirms previous structures (e.g., Dickinson, A., 1922, ii, 145) and yields complete at. parameters. BrO_3 is a trigonal pyramid with O—O 2·95 A. and Br—O 1·78 A. 6 O surround each Na at 2·38 A. Results for $NaBrO_3$ and $KBrO_3$ are compared.   I. McA.

Optical studies on stovaine and three related compounds. B. CAMPBELL and M. L. WILLARD (Z. Krist., 1938, **100**, 111—119).—Crystallographic data including vals. of n are recorded for the benzoate hydrochlorides of the following tert.-NH_2-alcohols : $NMe_2 \cdot CH_2 \cdot CMeEt \cdot OH$, $NMe_2 \cdot CH_2 \cdot CMe_2 \cdot OH$, $NMe_2 \cdot [CH_2]_2 \cdot CMe_2 \cdot OH$, and $NMe_2 \cdot [CH_2]_3 \cdot CMe_2 \cdot OH$.   I. McA.

Structure of crystalline aliphatic compounds. Fine structure of n-triacontane, $C_{30}H_{62}$. R. KOHLHAAS and K. SOREMBA (Z. Krist., 1938, **100**, 47—57; cf. A., 1938, I, 390).—n-$C_{30}H_{62}$ shows an enantiotropic transition at 59·4°. X-Ray analysis of single crystals from $PhNO_2$ gives a rhombic cell containing 4 mols. with a 7·45, b 4·97, c 81·6 A.; ρ^{20} 0·939; probable space-group D_{2h}^{16}, indicating a plane, not a centre, of symmetry between mols. adjacent along c. Analysis of indexed estimated intensities (cf. Müller, A., 1928, 1176) yields the following detail for a plane zig-zag C_{30} skeleton : σ of C atom : 1·57±0·05 A.; C–C–C angle : 106·0±4·0°; increment per C atom along c : 1·26±0·04 A.; angle (α) between mol. chain plane and (010) : 26·5 < α < 33·6°. Müller's rule for odd and even n-paraffins requires amendment.   I. McA.

X-Ray and thermal examination of the glycerides. IV. Symmetrical mixed triglycerides.—See A., 1939, II, 97.

Effect of molecular structure on the occurrence of liquid crystals. C. WEYGAND and R. GABLER (Naturwiss., 1939, **27**, 28—29).—For the smectic forms of the homologous azoxy-, azo-, and azomethine-phenyl ethers, the transition point for the conversion of one liquid cryst. form into another falls on replacing the azoxy-group by the azo-group. The middle of the mol. thus controls the occurrence of the smectic state. Investigation of the occurrence of compounds of the type $OR \cdot C_6H_4 \cdot CH:N \cdot C_6H_4 \cdot CH_2R'$ and $OR \cdot C_6H_4 \cdot CH:N \cdot C_6H_4 \cdot OR''$ ($R = C_9H_{19}$, $R' = H$, Me, Et, $R'' = Me$, Et) in the nematic state shows that the ends of the mols. determine the ordering in this state.   A. J. M.

Relation between image distortion in the electron microscope and electron scattering in the object. M. VON ARDENNE (Z. Physik, 1938, **111**, 152—157).—The ratio of chromatic to electron scattering image distortion is calc. for various thicknesses of object. The bearing of these data on the resolving power and applicability of the electron microscope is discussed.   H. C. G.

Electron interference. H. BOOCHS (Physikal. Z., 1938, **39**, 919).—Using an improved electron dif-fraction camera, the velocity loss of electrons on passing through thin foils ($\sim$ 0·8—3 μ.) of Al and mica was investigated. The loss is that which would be expected from observations on thicker foils. In experiments to discover whether the lattice consts. in very small crystallites differ from those of larger crystallites, only in the case of Ni was any considerable difference found.   A. J. M.

New process of photographing electron interference at single molecules. P. DEBYE (Physikal. Z., 1939, **40**, 66).—The intensity of secondary electrons produced by the scattering of an electron beam at single mols. is a function of the angle of deviation, the factor controlling the decrease in intensity being $\propto 1/s^4$ ($s = 2 \sin \theta/2$). A method of eliminating this factor involves the use of a rotating sector in front of the photographic plate, the aperture of the sector being so arranged as to increase the exposure at a point distant r from the centre in the ratio r^1, thus approx. compensating for the $1/s^4$ decrease. The method is applied to CCl_4.   A. J. M.

Determination of the molecular structure of gases by electron diffraction. C. FINBAK (Tids. Kjemi, 1938, **18**, 168—172).—A review.   M. H. M. A.

Examination of thin rubber films by electron diffraction. K. TANAKA (Mem. Coll. Sci. Kyoto, 1938, A, **21**, 169—172).—The mol. structure of a thin rubber film deposited on a polished metal surface from a C_6H_6 solution is similar to that in a paraffin crystal.   F. J. L.

Molecular structure of hydrogen fluoride. S. H. BAUER, J. Y. BEACH, and J. H. SIMONS (J. Amer. Chem. Soc., 1939, **61**, 19—24).—Electron-diffraction investigation gives the interat. distances F—H 1·00 $\pm$ 0·06 A., F- - -H 1·55 $\pm$ 0·06 A., F—H - - - F 2·55 $\pm$ 0·03 A., < FFF 140 $\pm$ 5°. The data indicate a zig-zag chain configuration. The probability of the existence of equilibrium between chain polymerides is discussed.   E. S. H.

Influence of heat-treatment in a magnetic field on the magnetic properties of ferromagnetic single crystals. R. JAANUS and J. SCHUR (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 287—288).—The variation of coercive force in the plane of the disc with direction has been investigated in Si steel (3·5% Si) single-crystal discs after heating to 800° and cooling under magnetic cover or in a magnetic field in various directions in the plane of the disc. Results of Ruder (A., 1935, 687) and Sixtus (A., 1937, I, 556) may have been influenced by the magnetic field of the coils of the electric furnace used in heat-treatment.   O. D. S.

Magnetic permeability of nickel for Hertzian waves. K. F. LINDMAN (Z. tech. Physik, 1938, **19**, 323—324).—The magnetic permeability of Ni has been determined when waves of λ 15·8—86 cm. are passing through the metal, the λ of the waves in two parallel Ni wires of diameter 0·0172 mm. being found and compared with the normal λ. The permeability increases with increasing λ, at first rapidly (λ <50 cm.), then more slowly, reaching the val. 19·9 at λ 86·0 cm.   A. J. M.

Effect of an elastic anisotropy on the X-ray determination of strains. R. GLOCKER (Z. tech. Physik, 1938, **19**, 289—293).—Theoretical. Assuming independent extension for each crystallite, the elastic anisotropy of polycryst. Fe to be expected from X-ray determinations of the extension is calc. to be $\gg$ that obtained by experiment. The anisotropy is considered in connexion with the angle of incidence of the X-rays.　　　A. J. M.

Investigation of the transitions of condensed hydrogen halides with the polarisation microscope. A. KRUIS and R. KAISCHEW (Z. physikal. Chem., 1938, **B, 41**, 427—432).—Observations with the polarisation microscope indicate that the transition of HCl at 98·9° K. and, contrary to the results of X-ray investigations (A., 1932, 325), the transitions of HBr and HI at $\sim$ 117° and 126° K., respectively, are due to lattice changes. The transitions of HBr at 113° and 89° K. and of HI at 70° K. are due to re-crystallisation.　　　J. W. S.

Retrograde transitions. A. SMITS (Z. physikal. Chem., 1938, **B, 41**, 441—452).—Theoretical. The conditions for the appearance of retrograde transitions are discussed from the viewpoint of the author's theory of allotropy.　　　J. W. S.

Transition of amorphous metals to the crystalline state. J. KRAMER (Z. Physik, 1938, **111**, 409—422; cf. A., 1934, 244).—The structure of amorphous metals is likened to that of a highly compressed gas in which by reaction from neighbouring atoms the ionisation energy is largely reduced. This thesis is developed in a no. of comparisons; e.g., transition of an amorphous metallic layer through impact of accelerated electrons corresponds with ionisation of a gas by electron impact. The effect on the transition temp. of an amorphous layer of a magnetic field may be calc. from the formulæ for the separation of the spectral lines in the normal Zeeman effect. Likewise the fall in resistance of a thin metallic layer in an electrostatic field is comparable with the Stark effect.　　　L. G. G.

Transitions between organisation and disorganisation in solid and liquid phases. C. WAGNER (Z. Elektrochem., 1939, **45**, 1—2).—Problems relating to the various intermediate states between ideal mol. orientation (perfect crystal) and complete disorganisation (perfect gas) are stated.　　　J. W. S.

Transition between organisation and disorganisation in ionic crystals. F. LAVES (Z. Elektrochem., 1939, **45**, 2—13).—Various forms of distortion of an ionic crystal lattice, with and without mixed crystal formation, are classified and discussed.　　　J. W. S.

Statistics and thermodynamics of the state of disorganisation in crystals, especially at low order of deficiency. W. SCHOTTKY (Z. Elektrochem., 1939, **45**, 33—68).—Mathematical.　　　J. W. S.

Resolution of the elementary moment of ferromagnetic substances and gyromagnetic phenomena. R. FORRER (Compt. rend., 1938, **207**, 1390—1391).—Experimental vals. of the gyromagnetic ratio $\rho(e/m)$ for ferromagnetic metals are compared with vals. calc. by resolution of the elementary moment into its orbital and spin components.　　　A. J. E. W.

Magnetic susceptibility of potassium bromide crystals with colour centres. P. JENSEN (Ann. Physik, 1939, [v], **34**, 161—177).—The difference, Δx, in the vol. susceptibility of the same KBr–KH mixed crystal before and after coloration by exposure to light has been measured for a series of crystals of colour centre concn. N from 1×10^{17} to 6×10^{17} centres per c.c. For this range of concn., $\Delta x = 2·6 \times 10^{-27} N$. The effective moment of a centre is calc. to be 1·93 Bohr magnetons. Within the experimental error this is equal to the effective moment of a Na atom calc. from the susceptibility of Na vapour.　　　O. D. S.

Magnetic behaviour of vanadium, titanium, and chrome alums. J. H. VAN VLECK (J. Chem. Physics, 1939, **7**, 61—71).—The three possible sources from which can result the crit. val. of the ratio of the fourth- to the second-order part of the non-cubic portion of the cryst. potential of Ti and V alums are investigated theoretically: (i) the atoms more remote than the 6 H_2O mols. immediately surrounding the paramagnetic ion, (ii) the indirect action of the remote atoms in distorting or polarising the H_2O cluster, and (iii) the Jahn–Teller effect in which the degeneracy of the cation distorts the arrangement of the H_2O cluster. Only (ii) gives a ratio of the correct size and sign, but (iii) amplifies the effect. This idea is supported by reference to Cr alum.　　　W. R. A.

Jahn–Teller effect and crystalline Stark splitting for clusters of the form XY_6. J. H. VAN VLECK (J. Chem. Physics, 1939, **7**, 72—84; cf. preceding abstract).—Mathematical.　　　W. R. A.

Influence of water on the values of the magnetic constants of the rare earths. B. CABRERA (Compt. rend., 1938, **207**, 1077—1080).—In order to determine whether contained H_2O is the primary cause of the discrepancies between the observed and predicted vals. of the magnetic consts. of the rare earths, three samples of Sm_2O_3 have been studied magnetically between room temp. and 300°. Parallel curves were obtained which were made to coincide approx. by correcting for the amounts of contained H_2O, determined by drying the samples at 700°. Investigation of the rare earths shows that the Curie const. C_c of the cation obtained from the sulphate is always $>$ that from the oxide, even when the oxide is prepared from the sulphate by heating at 1000° in air. This anomaly is also due to H_2O contained in the oxide.　　　W. R. A.

Paramagnetic dispersion and absorption. C. J. GORTER (Physikal. Z., 1938, **39**, 815—823).—Methods and results of the investigation of paramagnetic dispersion in a const. parallel magnetic field are described. At liquid air temp. dispersion occurs for a frequency of $\sim 10^6$ Hz. The dispersion curve for Cr and Fe^{III} alums is flatter than corresponds with a simple Debye curve. The results of paramagnetic absorption experiments can be explained by the existence of very short relaxation times' independent of temp. The absorption in Fe^{III} alum increases considerably when a const. magnetic field is applied. The height of the max. increases with increasing field

strength. Theories of paramagnetic dispersion and absorption are discussed.   A. J. M.

Residual paramagnetism in compounds of lanthanum. R. B. HALLER and P. W. SELWOOD (J. Amer. Chem. Soc., 1939, 61, 85—88).—Magnetic susceptibilities of $La_2(SO_4)_3,9H_2O$, $La_2(C_2O_4)_3,10H_2O$, and La_2O_3 (prepared in two ways) have been determined at 20° and −150°. Slight residual paramagnetism was observed in all the compounds. The causes of the phenomenon are discussed.   E. S. H.

Mechanism of paramagnetic relaxation. R. DE. L. KRONIG (Physica, 1939, 6, 33—43, 240).—The negative effect of a const. magnetic field on the paramagnetic susceptibility of Ti–Cs alum in alternating magnetic fields at low temp. (A., 1939, I, 66) is due to coupling of the spins to the orbital motion, which produces an interaction with the lattice vibration additional to that due to magnetic spin coupling. It is shown that this new effect is sufficient to explain the contrast between the behaviour of Ti^{+++} and that of Fe^{+++} and Cr^{+++}.   L. J. J.

Theory of relaxation phenomena. R. DE L. KRONIG (Physikal. Z., 1938, 39, 823—830).—The problem of relaxation depends on the rapidity with which thermodynamic equilibrium is attained between a large no. of similar systems of particles. The problem is treated mathematically, and acoustic and dielectric relaxation, and relaxation in metallic conductors, are considered.   A. J. M.

Paramagnetism of copper salts of normal fatty acids. J. AMIEL (Compt. rend., 1938, 207, 1097—1099).—From the mol. susceptibilities, determined by a Curie–Chéneveau balance at 20°, for the solid Cu^{II} salts of 15 fatty acids, HCO_2H to $C_{17}H_{35} \cdot CO_2H$, χ_{Cu} is between 830 and 895 × 10^{-6} for all except the anhyd. and hydrated formates. This gives ∼1700 for χ_{Cu}··.   W. R. A.

Thermo-electric potential of the element metal–semi-conductor–metal. II. Variation with temperature, from −80° to 70°, of the thermo-electric power of cuprous oxide. H. SCHWEICKERT. **III. Variation with temperature difference of the thermo-electric power of cuprous oxide.** W. ROHDE. **IV. Experimental and theoretical results for cuprous oxide.** G. MÖNCH (Ann. Physik, 1939, [v], 34, 250—258, 259—264, 265—279; cf. Mönch, A., 1936, 923).—II. The thermo-electric power, P, of Cu_2O increases with decreasing temp. P is independent of the temp. difference, ΔT, between the junctions when $\Delta T > 4°$; when $\Delta T < 3°$ P increases with decreasing ΔT. Sudden changes in P at ∼30° and −70° are correlated with changes of slope in the curve of log resistance against $1/T$.

III. The magnitude of the sudden change in P at about 30° decreases with decreasing ΔT and is zero when $\Delta T = 1°$. P and its variation with ΔT depend on the method of heating the junction according to whether there is a fall or rise of temp. on passing from the metal to the Cu_2O; previous abs. vals. of P are therefore inaccurate to about 5%.

IV. Theoretical.   O. D. S.

Theory of superconductivity. A. PAPAPETROU (Z. Physik, 1938, 111, 318—331).—The limiting conditions governing the two classes of conducting electrons are discussed.   H. C. G.

Change of magnetic induction in superconductors carrying a current on transition to the superconducting state. K. STEINER and H. SCHOENECK (Physikal. Z., 1939, 40, 43—45).—For a hollow Sn cylinder carrying a current the paramagnetism induced on transition to the superconducting state is accompanied by a sudden increase of current on the inner surface. This is ascribed to the presence of a fine cryst. layer on the inner surface, produced by the boring, this layer having a higher transition temp. than the remainder of the cylinder. Moulded or pressed specimens do not show the phenomenon.   A. J. M.

Model of the superconductor based on electron theory. H. WELKER (Physikal. Z., 1938, 39, 920—925).—Theoretical. A model of the superconductor based on an extension of London's theory is given.   A. J. M.

Magnetic and thermodynamical functions in the superconductive, intermediate, and normal states. P. H. VAN LAER (Physica, 1939, 6, 1—16).—Theoretical. Magnetic properties, S, H, U, and G are considered, particularly for Sn.   L. J. J.

Apparatus for measuring the velocity of sound in liquids by a resonance method. Measurement of the velocity of sound in mercury. C. SALCEANU (Compt. rend., 1938, 207, 1184—1186).—Details are given of a simple resonance-tube apparatus employing aural detection of resonance max. The velocity of sound (1290 and 1535 cycles per sec.) in Hg at 22·5° is 1407 m. per sec.   A. J. E. W.

Acoustic relaxation phenomena. H. O. KNESER (Physikal. Z., 1938, 39, 800—806).—The occurrence of relaxation phenomena in acoustics is considered. They are due to the fact that the energy imparted to a body by rapid compression is not divided equally amongst all the degrees of freedom of the mols. corresponding with thermal equilibrium. This gives an apparent increase in compressibility and a corresponding increase in the velocity of sound. The absorption and dispersion of sound in gases are considered. The observed relaxation phenomena can be ascribed to the conversion of translational and rotational energy into vibrational energy. The relaxation time is 10^{-3}—10^{-5} sec. The process is more complicated for liquids, which show a strong absorption of sound. The relaxation time in this case has an upper limit of ∼10^{-8} sec. The relaxation in the case of liquids may be conditioned by the structure of the liquid.   A. J. M.

Isochromatic investigation of sound amplitude fields. E. HIEDEMANN and K. OSTERHAMMEL (Proc. Indian Acad. Sci., 1938, 8, A, 275—280; cf. A., 1937, I, 70).—An isochromatic method in which the amplitude distribution in sound fields is made visible is described. Lines of equal amplitude have the same colour.   W. R. A.

Scattering of light in a Rochelle salt crystal. L. SIBAIYA (Proc. Indian Acad. Sci., 1938, 8, A,

393—396).—The structure patterns of the scattered Hg arc lines 4358 and 5461 A. obtained with a Rochelle salt crystal (I) have been examined, and the displacement of the Doppler–Brillouin components measured. From these a val. of 3·53 km. per sec. is calc. for the velocity of the thermal sound waves in (I).

W. R. A.

Diffraction of light by supersonic waves. N. S. N. NATH (Proc. Indian Acad. Sci., 1938, **8**, A, 499—503).—Mathematical. The elementary theory of the diffraction of light by supersonic waves in liquids (A., 1936, 555) is applied to the case where the supersonic field is not strong enough to excite the second or higher orders of diffraction. The theory is valid for all frequency regions. The significance of the derived equations in the theory for solids is discussed.

W. R. A.

State of liquid helium near absolute zero. F. LONDON (J. Physical Chem., 1939, **43**, 49—69).—Theoretical. The phase transition (λ-point) which liquid He undergoes at 2·19° K., and other changes in properties near this temp., are discussed with reference to the discontinuity in the sp. heat curve which an ideal Bose–Einstein gas would show.

C. R. H.

Application to nickel of a new method of measurement of true specific heats. L. NÉEL (Compt. rend., 1938, **207**, 1384—1386).—The method involves determination of the temp. rise of a 100-g. cylinder, heat being supplied by a momentary current through a resistance. Data for Ni (14—540°) confirm the results of Ahrens (A., 1935, 20), c_p falling rapidly above the Curie point (357·5°).

A. J. E. W.

Specific heat of β-brass. R. EISENSCHITZ (Proc. Roy. Soc., 1938, A, **168**, 546—566).—A theoretical investigation in which it is assumed that the interaction energies of the atoms vary with the square of the change of vol., and the Bragg–Williams theory is applied to a lattice containing a finite no. of atoms. Good agreement with the experimental vals. is obtained. A general theorem of statistical mechanics is derived, according to which all thermodynamical quantities in physically realisable systems are analytic functions of the temp.

G. D. P.

Exact measurement of specific heat and other physical properties of solid substances at high temperatures. XI. Specific heat, electrical resistance, thermo-electrical behaviour, and thermal expansion of electrolytic iron. F. M. JAEGER, E. ROSENBOHM, and A. J. ZUITHOFF (Rec. trav. chim., 1938, **57**, 1313—1340; cf. A., 1936, 1058).—The c_p–θ curve of pure electrolytic Fe, determined from measurements between 100° and 1500°, shows discontinuities at 130° to 190° indicating changes in the inner condition of α-Fe, shown not to be modifications of cryst. form by X-rays. A gradual change of α- into β-Fe occurs between 200° and 760°, the Curie point, at which temp. a marked contraction in sp. vol. occurs. C_p of δ-Fe and of liquid Fe are independent of temp. No one phase of the metal appears to be in a state of completed thermal equilibrium. C_p for Fe is > 3R g.-cal. even at 100°. Phenomena relating to c_p, R, thermo-electric properties, and thermal expansion of Fe around the transition temp.

760°, 906°, and 1401° are described. The existence of transition intervals and of intermediate, physically non-homogeneous phases which may be stabilised by strongly retarding forces renders the application of thermodynamical reasoning to these phases unjustified.

F. H.

Specific heats at low temperatures of manganese, manganous selenide, and manganous telluride. K. K. KELLEY (J. Amer. Chem. Soc., 1939, **61**, 203—207).—Sp. heat data for the range 53° K. to room temp. are recorded. The behaviour of MnSe and MnTe is anomalous. Entropy vals. (298·1° K.) recorded are : Mn 7·61±0·06, MnSe 21·7±0·5, MnTe 22·4±0·5. The free energy of formation at 298·1° K. has been calc. for MnO −91,220, MnS −45,430, and MnSe −22,670 g.-cal.

E. S. H.

Heat capacity of Rochelle salt between −30° and 30°. A. J. C. WILSON (Physical Rev., 1938, [ii], **54**, 1103—1109).—Measurements by the method of adiabatic electric heating were made on specimens of single crystals and coarse powder crystals. The heat capacities are nearly the same for each, and straight line expressions are obtained. There are signs of anomalies at ∼ −18° and 24° of a direction and magnitude in agreement with theory. N. M. B.

Atomic distribution function for liquid sodium. C. N. WALL (Physical Rev., 1938, [ii], **54**, 1062—1067). —On the basis of a simple liquid model and Trimble's experimental distribution curves for liquid Na (cf. A., 1938, I, 179) an at. distribution function is developed. An approx. val. of the free vol. of the liquid as a function of the abs. temp. is obtained. By means of the free energy equation the entropies and latent heats of fusion and vaporisation for liquid Na are calc. and compared with observed vals.

N. M. B.

Apparent and partial molal heat capacities and volumes of glycine and glycollamide. F. T. GUCKER, jun., W. L. FORD, and C. E. MOSOR (J. Physical Chem., 1939, **43**, 153—168).—Data have been obtained at 5°, 25°, and 40°. The apparent mol. heat capacity and mol. vol. are approx. linear functions of molarity. The vals. for glycine are < those for glycollamide, the difference being greater at low than at high temp. Unpublished calculations of Edsall, based on thermochemical and e.m.f. data, predict this greater difference at low temp. The differences are also discussed in terms of the electrostriction and mutual interaction of zwitter ions.

C. R. H.

Mechanism of fusion. R. LUCAS (Compt. rend., 1938, **207**, 1408—1410).—Theoretical. The rôle of the rigidity modulus is considered, with reference to thermal agitation waves in crystals.

A. J. E. W.

Liquid state and energy of vaporisation. J. H. HILDEBRAND (J. Chem. Physics, 1939, **7**, 1—2).—The equation of Hildebrand and Wood for the potential energy of a liquid in terms of its structure (A., 1934, 146) has been tested for K at 70° and 395°, using the data of Thomas and Gingrich (A., 1938, I, 500). The energies of vaporisation, from the equation, are in the ratio of 1·154 and from v.p. data, 1·155. C_6H_6 and K exhibit the same decrease in the van der Waals a for temp. intervals corresponding with equal expansion ratios.

W. R. A.

Freezing of solutions as a method of studying problems in pure chemistry. XII. Polymorphism in homologous series of saturated normal alkyl acetates and ethyl esters of saturated normal fatty acids. R. VAN BELLINGHEN (Bull. Soc. chim. Belg., 1938, **47**, 640—688; cf. A., 1938, I, 141).—Existing data relating to the m.p. and the polymorphic forms of these substances have been amplified and, where necessary, corr., by the study of carefully purified material. In the series $C_nH_{2n+1}\cdot OAc$ polymorphism is not shown below $n = 11$, whilst α, β_1, and β_2 forms occur in the higher members when n is odd, and α and β_2 when n is even. In descending the series $C_{n-1}H_{2n-1}\cdot CO_2Et$ polymorphism ceases with $n = 8$. The members with $n = 8$—13 inclusive exhibit an unstable γ form. The following m.p. data are recorded (nos. in brackets denote the no. of C atoms in the alcohols and acids used in making the acetates and Et esters, respectively. Acetates [9] β_2 −26.0°; [10] β_2 −15.05°; [11] α (−29.5°), β_1 −13.15°, β_2 −6.8°; [12] α (−16.0°), β_2 1.1°; [13] α (6.0°), β_1 2.5°, β_2 8.4°. Et esters [6] β −67.6°; [7] β −66.3°; [8] β −43.2°, γ −59.2°; [9] α (−55.0°), β −36.8°, γ −43.6°; [10] β −19.95°, γ −30.6°; [11] β −14.7°, γ −19.25°; [12] β −1.75°, γ −11.4°; [13] α (−4.6°), β −0.9°, γ −3.6°; [16] α 19.5°, β 24.0°; [18] α 30.9, β 33.4°. The m.p. of the α-form is directly measurable only for the higher members ($n > 14$), and the vals. shown in parenthesis were obtained by the method of mixtures.   F. L. U.

Piezometric researches. V. Anisotropic liquids under pressure. J. ROBBERECHT (Bull. Soc. chim. Belg., 1938, **47**, 597—639).—The temp. of fusion to anisotropic liquid (m.p.) and of the transformation anisotropic $\rightleftharpoons$ isotropic liquid (θ) was measured at pressures between 1 and 940 atm. for 14 compounds. The following data for 1 atm. are recorded (m.p. first in each case): cholesteryl chloride 96.8°, 62.0°, formate 97.2°, 62°, acetate 114.3°, 94°; propionate 95.9°, 113.8°, n-butyrate 98.6°, 109.8°, n-valerate 91.6°, 98.6°, n-hexoate 93.0°, 96.6°, methylcarbonate 114.0°, 104.5°, ethylcarbonate 83.2°, 103.8°, n-propylcarbonate 99.0°, 101.4°; p-azoxyanisole 117.8° 135.9°; Et p-azoxybenzoate 113.0°, 119.8°; p-azoxyphenyl ethylcarbonate 101.8°, 137.8°; p-azophenyl ethylcarbonate 96.0°, 121.1°; anisylideneaminoacetophenone 122.7°, 97°. Vals. of $d\theta/dp$ for fusion and transformation were also determined. In cases where the metastable transformation is not observable at 1 atm. it may become so at high pressures, since $d\theta/dp$ (transformation) is always $>$ $d\theta/dp$ (fusion). Vals. of θ not directly measured at 1 atm. are obtained either by extrapolation from higher pressures, or by studying the behaviour of mixtures and extrapolating to 100% composition. Apparatus used for the high-pressure work is described.   F. L. U.

System correlating molecular structure of organic compounds with their b.p. I. Aliphatic b.p. numbers. C. R. KINNEY (J. Amer. Chem. Soc., 1938, **60**, 3032—3039).—When Walker's equation, $T = aM^b$ (T = b.p. in °K.; M = mol. wt.; a and b are consts.) (J.C.S., 1894, **65**, 193), is applied to homologous series, a is typical of the series and b is generally ∼0.33. Instead of mol. wts., M may be the sum of vals. empirically assigned to the constituent atoms; in the H_2–n-paraffin series the best "fit" is obtained if vals. 0.8 and 1 are assigned to H and C, respectively. These vals. are called "at. b.p. nos." (B.P.N.). For a compound the sum of the appropriate vals. is called the "mol. B.P.N." If the b.p./1 atm. is given in °C., the equation, b.p. = 230.14(B.P.N.)$^{0.33}$ − 543, may be used to calculate the B.P.N. For 19 n- and 61 branched-chain hydrocarbons calc. and observed B.P.N. agree within 5%, although many of the latter were not determined at exactly 1 atm. A substituent in the middle, but not at the end, of a chain has a low B.P.N.; the decrease is still greater for *gem.* groups. B.P.N. are calc. for alkyl, OH, CO_2H, NH, $:N$, CN, NC, Cl, ethereal O, O in CO and CHO, and O_2 in esters, from typical series, and are typical for each mode of combination and each type of substituent. The utility of the B.P.N. is illustrated by deducing (within limits) the structures of the 8 chloropentanes from their b.p.   R. S. C.

Vapour pressure and critical constants of butane. J. A. BEATTIE, G. L. SIMARD, and G. J. SU (J. Amer. Chem. Soc., 1939, **61**, 24—26).—V.p. have been determined at 25° intervals from 75° to 150°. The crit. consts. are: t_c 152.01±0.01° (Int.), p_c 37.47±0.02 normal atm., v_c 4.44 c.c. per g. (±1%), d_c 0.225 g. per c.c. (±1%). n-C_4H_{10} confined in a glass vessel by Hg does not decompose perceptibly at temp. <300°.   E. S. H.

Intermolecular forces and the properties of gases. J. O. HIRSCHFELDER and W. E. ROSEVEARE (J. Physical Chem., 1939, **43**, 15—35).—The Beattie-Bridgeman equation is the best for representing p-v-T relations for gases up to $p = 100$ atm. From this equation and from Joule–Thomson coeffs. extrapolated to $p = 0$, the energy of interaction and the collision diameter of mols. can be calc. At p ∼3000 atm. the internal energy of a gas at const. T is a linear function of its d, i.e., $[\delta U/\delta(1/v)]_T$ is a const. independent of p for all vals. of T. This linearity is described most easily in terms of the Menke probability function.   C. R. H.

Pressure–density diagram of elements at higher pressures and at absolute zero. H. JENSEN (Z. Physik, 1938, **111**, 373—385).—Theoretical.   L. G. G.

Investigations on the saturation state of water from 350° to the critical temperature. H. ECK (Physikal. Z., 1939, **40**, 3—15).—The sp. vol. of H_2O and H_2O vapour was determined over the range 350°—crit. temp. (determined to be 374.2$_3$°) by a direct method. The crit. vol. is 3.065$_6$ c.c. per g. The crit. pressure of H_2O was determined by another method to be 225.5$_1$ kg. per sq. cm. From determinations with H_2O and mixtures of H_2O and D_2O the following vals. for D_2O are obtained: crit. temp. 371.5°; crit. vol. 2.74 c.c. per g.; crit. pressure 221.5 kg. per sq. cm.   A. J. M.

Octanes. A. MAMAN (Compt. rend., 1938, **207**, 1401—1402; cf. A., 1937, I, 558).—Vals. of d, n, the dispersion, the crit. solution temp. in NH_2Ph, and the temp. at which CO appears in the products of com-

bustion are recorded for five isomerides. Vals. of η at 5—20° are also given for 14 isomerides. Andrade's const. A for n-C_8H_{18} and $\beta\beta\delta$-trimethylpentane decreases with rising temp. A. J. E. W.

Thermal coefficient of rock-salt by X-ray reflexion. S. BASU and A. T. MAITRA (Indian J. Physics, 1938, **12**, 305—316).—The distance between at. planes in rock-salt has been measured by the X-ray method from 30° to 450°. The spacing at temp. θ c. is given by $2\cdot81400[1 + 0\cdot00004162(\theta - 18)]$ A.
J. A. K.

Thermal expansion of crystals in relation to their structure. H. D. MEGAW (Z. Krist., 1938, **100**, 58—76).—Theory based on the Born two-term function for lattice energy allows the expression of expansion coeffs. (α) in terms of the power law index n, and mol., lattice, and general consts. The measure of agreement with fact, and the basis of classification developed, are reviewed in data for elements (excluding metals), alkali halides, salts, oxides, silicates, and hydrates. For homodesmic crystals (those with a uniform type of at. linking; e.g., NaCl, diamond, A) the rule $\alpha = kz^2/p^2$ is established, where z is the ionic valency and p the co-ordination no. Anisotropy, anomalies, and the bearing on the nature and location of at. forces are discussed. I. McA.

Thermal expansion of solids at low temperature. II. (Cr, β-Mn, Mo, Rh, Be, graphite, Tl, Zr, Bi, Sb, Sn, and beryl.) H. D. ERFLING (Ann. Physik, 1939, [v], **34**, 136—160; cf. A., 1936, 674).—Thermal expansion coeffs. have been measured between —215° and 20°. The formula of Grüneisen is obeyed by Mo and Rh, and by Cr and Mn at low temp. The linear expansion coeff., β, of Cr has a min. val. between 0° and 50°. β of β-Mn is decreased by absorption of N_2. Be, graphite, Bi, Sb, and Sn show varying temp. functions of $\beta_{||}$ and $\beta_{\perp}$, but their vol. expansion coeffs. follow curves similar to the corresponding at. heat curves although they cannot be represented by a single Debye function. Beryl shows anomalies similar to those observed for calcite (loc. cit.); $\beta_{||}$ is negative at 0° and the vol. expansion coeff. becomes negative at —11°. O. D. S.

Intermolecular action. G. SCATCHARD (J. Physical Chem., 1939, **43**, 1—3).—Introduction to a symposium. C. R. H.

Year's progress in the precise measurement of the effects of intermolecular potential in gases. S. C. COLLINS and F. G. KEYES (J. Physical Chem., 1939, **43**, 5—14).—Mathematical. Recent attempts at accurate measurement of the change of enthalpy with pressure are reviewed, and data obtained for N_2 by the method previously described (cf. Proc. Amer. Acad. Arts, 1938, **72**, 283) are tabulated. C. R. H.

Liquid state. J. F. KINCAID and H. EYRING (J. Physical Chem., 1939, **43**, 37—47).—Theoretical. The conditions necessary for an equation of the van der Waals type to be valid over the entire range of vols. from dil. gas to dense liquid are examined.
C. R. H.

Compressibility of and an equation of state for gaseous n-butane. J. A. BEATTIE, G. L. SIMARD, and G. J. Su (J. Amer. Chem. Soc., 1939, **61**, 26—

27).—Compressibilities have been determined at 150—300° and 0·5—8·5 mol. per l. The consts. of the Beattie–Bridgeman equation of state have been evaluated from data for $d <$ the crit. (3·88 mol. per l.).
E. S. H.

Relation between vapour pressure, viscosity, and molecular association. E. LUCATU (Compt. rend., 1938, **207**, 1403—1405).—The relation $p\eta^\alpha = 10^k$, where k is const., has been verified for a no. of org. liquids, although the log η/log p curves show a break at $p = \sim1$ atm. $\alpha = \sim4\cdot5$ for normal liquids, associated liquids giving lower vals. For Hg and H_2O the log η/log p curves are hyperbolic, H_2O giving two hyperbolæ intersecting at $\sim40°$. H_2O becomes "normal" ($\alpha = 4\cdot5$) at 300°. A. J. E. W.

Deviation of the viscosimetric from the mean mol. wt. for materials with a mol. wt. distribution according to the Gauss law of errors. G. V. SCHULZ (Z. physikal. Chem., 1938, **B**, **41**, 466—468; cf. A., 1936, 678).—The equation previously derived is corr. and applied to data for fractionated polystyrene and cellulose nitrates. J. W. S.

Viscosity of non-polar liquids. S. KYROPOULOS (J. Chem. Physics, 1939, **7**, 52—57).—The structural characteristics of the individual mol. of a substance in the liquid state determine the formation of groups of mols., the type and strength of association, and the residual fields of the groups. The residual fields, which are essentially dispersion forces, in turn determine the η of the liquid. W. R. A.

Viscosity of solids. II. Thermal damping for bending vibrations. K. BENNEWITZ and H. RÖTGER (Physikal. Z., 1938, **39**, 835—840; cf. A., 1936, 1192).—The theory of the thermal damping of bending vibrations is dealt with by considering the form of the dispersion curve of the decrement, the magnitude of the max. decrement, and the frequency. The results of the theory are verified experimentally with German silver. A. J. M.

Low-temperature properties of gaseous helium. H. S. W. MASSEY and R. A. BUCKINGHAM (Proc. Roy. Soc., 1938, **A**, **168**, 378—389).—The viscosity, η, and second virial coeffs. are calc. in the range 0—26° K. There is good agreement with the observed η down to 15° K. but at lower temp. the calc. vals. are too small. The calc. vals. of the virial coeff. are also in error. The discrepancies are discussed and the changes in the initial assumptions which will lead to their elimination are indicated. G. D. P.

Viscosity of liquid helium and Bose–Einstein statistics. L. TISZA (Compt. rend., 1938, **207**, 1186—1189).—Expressions are derived for the temp.-dependence of η in liquid He. Anomalous capillary phenomena exhibited by He II are explained by the existence of a superfluid phase. A. J. E. W.

Viscosity of n-butanol. G. JONES and S. M. CHRISTIAN (J. Amer. Chem. Soc., 1939, **61**, 82—83).—Vals. of d and η (abs. units) at 0° and 25° are 0·8246, 0·05216 and 0·80572 and 0·02605, respectively.
E. S. H.

Chemical constitution and viscosity, with reference to aromatic hydrocarbons with long side-chains. A. W. SCHMIDT, G. HOPP, and V.

SCHOELLER (Oel u. Kohle, 1938, **14**, 985—990).—The η-temp. curves of hydrocarbons of the series PhC_nH_{2n+1} from $n = 1$ to $n = 18$, and of the monochloroparaffins, $C_nH_{2n+1}Cl$, from $n = 8$ to $n = 18$, become less steep as n increases. The results are at variance with Mikeska's data for the two members of the former series for $n = 18$ and $n = 22$ (B., 1936, 1077).
                    A. B. M.

Viscosity and chemical constitution. G. HUGEL (Oel u. Kohle, 1939, **15**, 27—29).—The constitutional effect on η is expressed by a factor of the const. a in the equation $\log_e \eta - \alpha = Q/R(T - b)$. For homologues of simpler constitution there is a linear relationship between a and Q, b being zero, but this does not hold for more complex substances, especially those containing several active groups. Although the ketones are associated liquids, they have the same logarithmic increment of η per CH_2 as the paraffins, so that the arrangement of the mols. is similar.   A. R. PE.

Luminescence of vapour-gas mixtures. S. E. FRISCH (Sci. Mem. Univ. Leningrad, 1937, **3**, No. 17, 133—148).—A review of the literature.   R. T.

Intermolecular forces in liquid systems. II. Viscosity, surface tension, and parachor relationships in binary systems. S. T. BOWDEN and E. T. BUTLER (J.C.S., 1939, 79—83).—Surface tension (γ) and viscosity (η) measurements have been made on the systems Me_2CO_3 or Et_2CO_3 with C_6H_6, $CHCl_3$, $PhNO_2$, CCl_4, or $MeCN$. With the exception of the $PhNO_2$ systems, the η-composition curves follow Errera's rules (cf. A., 1929, 130, 387). The γ-composition curves show a min. corresponding with identity of surface and bulk phase in the cases of Me_2CO_3–C_6H_6, Et_2CO_3–$CHCl_3$, and Et_2CO_3–CCl_4. There is no obvious relationship between the surface adsorption and the dipole moments of the components. The parachor of the alkyl carbonates is const. in all systems except those containing $PhNO_2$, where it increases with concn. In liquid mixtures the parachor may under suitable conditions be found by extrapolation with an accuracy of 1%.   D. F. R.

Order and disorder in liquid solutions. J. G. KIRKWOOD (J. Physical Chem., 1939, **43**, 97—107).—Mathematical. The author's method of treating order and disorder in solid solution (cf. A., 1938, I, 188) is applied to the investigation of local order in liquid solutions.   C. R. H.

Viscosity of solutions of sulphur dioxide in organic liquids. H. E. ADAMS and H. E. ROGERS (J. Amer. Chem. Soc., 1939, **61**, 112—115).—Data are recorded for η and d of SO_2 solutions in CCl_4, $CHCl_3$, and $CHBr_3$ at 25°. In each case, increase of vol. occurs on mixing. Comparison of vol. data with η shows that fluidity is $\propto$ the free vol.   E. S. H.

Densities of deuterium oxide–water mixtures at 5° and 25°. E. SWIFT, jun. (J. Amer. Chem. Soc., 1939, **61**, 198—200).—Data are recorded. The mixtures behave as ideal solutions from the viewpoint of d.   E. S. H.

Determination of the freezing and boiling points, at reduced pressure, of ethylene glycol–water mixtures. R. DELAPLACE and C. BÉCHARD (Compt. rend., 1939, **208**, 103—105).—Vals. of the f.p., and of the b.p. at 760, 596, 405, and 267 mm. are tabulated. The occurrence of a monohydrate is indicated.   A. J. E. W.

Volume changes of the methyl alcohol–toluene system. L. S. MASON and H. PAXTON (J. Amer. Chem. Soc., 1939, **61**, 67—69).—Data for d of 0—100% MeOH–PhMe mixtures at $-21.1°$, $0.0°$, $25.0°$, and $49.7°$ are recorded. The vol. changes on admixture have been calc.; further data at the b.p. have been obtained by extrapolation. Association, dissociation, and solvation effects, which may be responsible for the observed behaviour, are discussed.   E. S. H.

Nature of the solutions of metallic sodium in liquid ammonia. S. FREED and H. G. THODE (J. Chem. Physics, 1939, **7**, 85—86).—Polemical. The strong lowering of the v.p. of liquid NH_3 produced by dissolved Na indicates a true solution, in contradiction to the conclusion of Krüger (cf. A., 1938, I, 572), and this idea is supported by measurement of the magnetic susceptibility of the solutions. At great dilution the susceptibility increases roughly according to the Curie law.   W. R. A.

Viscosity of dilute solutions and suspensions in relation to particle form. A. PETERLIN (Z. Physik, 1938, **111**, 232—263; cf. A., 1938, I, 309).—A rigorous theoretical treatment is given.
                    L. G. G.

Viscosity and density of aqueous solutions of sulphuric acid at 35°. M. K. SRINIVASAN and B. PRASAD (Trans. Faraday Soc., 1939, **35**, 374—378).—Data for the full concn. range are recorded in tabular and graphical form. The η-composition curve shows a max. and a min. at 86 and 95 wt.-% of H_2SO_4, respectively. The curve of Irany's function ϕ (A., 1938, I, 610) against vol.-% shows max. deviations from linearity at compositions corresponding with $H_2SO_4,2H_2O$ and $12H_2SO_4,H_2O$, respectively. For 0.005—0.040M. solutions η varies according to $\eta/\eta_0 = 1 + 0.018\sqrt{c} + 0.114c$ ($c =$ concn.) and for higher concns. follows a modification of this equation. For concns. $\not> 0.075$M., $d = 0.99406 + 0.07c$. d is a max. for 99.2% H_2SO_4.   J. W. S.

Viscosities of complex salts in aqueous solution. C. E. FAWSITT and R. W. STANHOPE (J. Proc. Roy. Soc. New South Wales, 1937—1938, **71**, Part II, 230—241).—The η of aq. solutions of $Cu(NO_3)_2$, $CuCl_2$, $CuSO_4$, $AgNO_3$, $ZnSO_4$, $NiSO_4$, and $CoSO_4$ is lowered by addition of $(CH_2\cdot NH_2)_2$, $CO(NH_2)_2$, or sucrose. The decrease in η is not due simply to formation of complex salts since $KAg(CN)_2$ solution has η agreeing with the calc. val. C_5H_5N added to aq. $AgNO_3$ or $NiSO_4$ increases η. Conductivity measurements show the mobilities of the ions $[Cu\ en_2]^{++}$ and $[Zn\ en_3]^{++}$ to be slightly $>$ those of Cu^{++} and Zn^{++}, respectively. The increase in κ and decrease in η are probably due to replacement of 16 H_2O attached to Cu^{++} by 3 $(CH_2\cdot NH_2)_2$, producing an ion of greater mobility and a more dil. solution.   F. H.

Absorption [spectra] of aqueous solutions at 4.72 μ. E. S. BARR and C. J. CRAVEN (J. Chem. Physics, 1939, **7**, 8—10).—Using a grating spectrometer the infra-red absorption near 4.72 μ. has been

investigated for aq. solutions of KI, $CuBr_2$, $ZnBr_2$, $CdCl_2,2H_2O$, NaOH, $COMe_2$, NaOAc, NH_4OAc, PhOH, EtOH, and sucrose. The influence of the solute on the position of the H_2O band is discussed.
W. R. A.

Chemistry in liquid sulphur dioxide. IX. Electrical conductivity and dissociation of materials dissolved in liquid sulphur dioxide. X. Mol. wt. and association of materials dissolved in liquid sulphur dioxide. G. JANDER and H. MESECH (Z. physikal. Chem., 1939, **183**, 255—276, 277—296).—IX. The dissociation of various types of compounds in liquid SO_2 is discussed. The limiting conductivities of electrolytes in SO_2 are attained only at great dilution, and the Ostwald dilution law frequently holds for strong electrolytes at dilutions >8000 l. per g.-mol. The degree of dissociation and conductivity of electrolytes varies with the anion in the order $SCN' < ClO_4' < Cl' < Br' < I' < SbCl_6'$ and with the cation in the order $Na^{\cdot} < NH_4^{\cdot} < K^{\cdot} < Rb^{\cdot} < SMe_3^{\cdot} < NMe_4^{\cdot} < CMe_3^{\cdot}$, whilst the migration velocities of ions follow the order $SCN' < Br' < I' < ClO_4' < Cl'$, and $NMe_4^{\cdot} < K^{\cdot} < NH_4^{\cdot} < Rb^{\cdot}$. The variation of conductivity with temp. is also discussed.

X. Non-electrolytes are generally monomeric in liquid SO_2, whilst the only slightly dissociated thionyl compounds also show normal mol. wt. Binary salts, especially thiocyanates, are more or less associated in conc. solution. J. W. S.

Slow changes in physical properties of glass.—See B., 1939, 148.

Influence of tempering on the density of borate–soda glasses. M. FOËX (Compt. rend., 1939, **208**, 278—280).—Changes in d due to tempering, and the sp. vol. increments in normal and tempered specimens, are studied for Na_2O–B_2O_3 glasses ($\ngtr 55$ mol.-% Na_2O). The existence of the compounds $Na_2O,2$, 3, and $4B_2O_3$ is indicated. The tempered glasses probably occur in a metastable state involving dissociated mols. A. J. E. W.

Mixed crystals of cryolite with alumina. E. ZINTL and W. MORAWIETZ (Z. anorg. Chem., 1939, **240**, 145—149).—The mixed crystals of Na_3AlF_6 and Al_2O_3 have been studied by means of X-rays. It is confirmed that the limit of the series lies between 10 and 15% Al_2O_3 (cf. A., 1925, ii, 974). Mixed crystals with 5 and 10% Al_2O_3 have sensibly the same ρ and lattice consts. as pure Na_3AlF_6, and this is interpreted by supposing that Na_3AlF_6 is replaced by $2Al_2O_3 \equiv Al_3AlO_6$. F. J. G.

Mixed-crystal formation between some salt-like fluorides of different formula-type. E. ZINTL and A. UDGÅRD (Z. anorg. Chem., 1939, **240**, 150—156).—LiF takes at high temp. <5 mol.-% of MgF_2 into solid solution, instead of up to 20 wt.-% as stated by Bruni and Levi (A., 1925, ii, 281). Measurements of ρ for mixed crystals of CaF_2 and YF_3 confirm the suggestion of Goldschmidt ("Geochem. Verteilungsgesetze," 1926, VII, 88) that $Y^{\cdots}$ replaces $Ca^{\cdot\cdot}$ in the CaF_2 lattice, the additional F' being accommodated in vacant spaces. The analogous view holds for SrF_2 and LaF_3, as found by Ketelaar

and Willems (A., 1937, I, 177), whose work is, however, criticised. CaF_2 takes up to 24 mol.-% of ThF_4 into solid solution, $Th^{\cdots\cdot}$ replacing $Ca^{\cdot\cdot}$ and an additional 2 F' being accommodated in vacant spaces.
F. J. G.

Mechanism of the diffusion of hydrogen through mercury. J. NIKLIBORC (Acta Phys. Polon., 1938, **7**, 34—44).—Investigation of the glow discharge between Hg electrodes in an atm. of Hg vapour and H_2 has shown that diffusion of the H_2 through the Hg is due, not to surface diffusion, but to vol. diffusion. The apparent velocity of diffusion attains to an exaggerated magnitude owing to the convection currents set up in the Hg by heating. HgH is formed during the discharge, and a mechanism for its formation and decomp. is proposed.
W. R. A.

Transition between organisation and disorganisation in metallic phases. G. BORELIUS (Z. Elektrochem., 1939, **45**, 16—30).—A review. The various forms of lattice distortion encountered in metallic mixed-crystal phases are classified and discussed, with particular reference to the gradual changes observed as one metal is replaced by another.
J. W. S.

Crystallography of alloys. F. LAVES (Naturwiss., 1939, **27**, 65—73).—A review dealing with the structural types of the various classes of alloys.
A. J. M.

Conduction of electricity and diffusion in semi-metallic alloys. III. ($Cu_{2-x}Te$). H. REINGOLD and H. BRÄUNINGER (Z. physikal. Chem., 1938, **B, 14**, 397—426; cf. A., 1938, I, 133).—The sp. conductivity, κ, of the alloys $Cu_{2-x}Te$, where $x = 0.05$—0·3, has been measured at $-180°$ to 400°. Max. κ is observed with $x = 0.2$, but the actual val. varies with the previous thermal history of the sample. After any particular treatment κ decreases with rise of temp. below 300°, but above this anomalies due to transitions from the γ- to the β-form ($\sim 320°$) and from the β- to the α-form ($\sim 360°$) are observed. These transition temp. are not appreciably altered by change in x. The thermo-e.m.f. of $Pt/Cu_{2-x}Te$ at $-150°$ to 100° varies considerably with the previous thermal treatment of the alloy. The coeff. of propagative diffusion has been measured for all three forms, and the transport nos. in the α- and β-forms are deduced. The results are interpreted on the basis of electron-deficiency and electron-excess conductivity. J. W. S.

Intermetallic compounds. E. ZINTL (Angew. Chem., 1939, **52**, 1—6).—Difficulties encountered in the purification, analysis, and determination of structure of such compounds are described. The limitations of the law of const. proportions and also of the Hume-Rothery valency electron law are discussed. An account is given of the contraction in at. radius experienced by certain metals when alloyed. K. W. P.

Natural amalgams. H. BERMAN and G. A. HARCOURT (Amer. Min., 1938, **23**, 761—764).—Of the three phases, α, β, and γ, of the system Ag–Hg (A., 1931, 1224) probably only the α- and γ-phases are represented in nature. The natural occurrences

of the α-phase, viz., arquerite, kongsbergite, and bordosite, should be regarded as varieties of Ag. The γ-phase, having a composition approx. Ag_2Hg_3, should be named moschellandsbergite (I). (I) from Moschellandsberg is body-centred, cubic with a_0 10·1 A.; space-group $Im3m^2$, and unit cell $Ag_{20}Hg_{30}$. (I) has a hardness 3·5, and ρ 13·48—13·71 (13·73 calc. from X-ray data). A new chemical analysis [F. A. GONYER] is recorded and compared with older analyses. Au and Pd amalgams are briefly discussed.
L. S. T.

Magnetic properties of copper amalgams. S. S. BHATNAGAR, P. L. KAPUR, and G. L. MITTAL (Current Sci., 1938, **7**, 279—280).—Freshly prepared Cu amalgams of all concns. are diamagnetic, the susceptibilities lying between the vals. for pure Hg and pure Cu. Conc. amalgams harden on keeping in vac. owing to a change of crystal structure and the susceptibility falls to a const. val. When kept in air the amalgam becomes paramagnetic owing to formation of CuO.
J. A. K.

Nickel amalgams. J. BOUGAULT, E. CATTELAIN, and P. CHABRIER (Compt. rend., 1939, **208**, 193—194).—Ni is readily amalgamated by Hg in presence of dil. HCl or H_2SO_4, H having a catalytic effect; H from Raney's Ni or from Ca or Na does not cause amalgamation. The amalgams are magnetic and retain H, which is removed in a vac.; on distillation they give non-pyrophoric Ni, which is readily re-amalgamated.
A. J. E. W.

Electronic structure of copper–aluminium alloys. J. FARINEAU (Compt. rend., 1939, **208**, 191—192).—The energy distribution in the Al $K\beta$ and Cu $L\alpha$ lines shows an energy difference of <0·04 e.v. between the ordered and disordered states in an alloy containing 5·2% of Cu. The conductivity electrons in Al_2Cu occur in three Brillouin zones giving max. at ~6, 8, and 10·5 e.v. from the long-λ edge.
A. J. E. W.

κ-Phase adjacent to α-phase in the copper–silicon system. M. OKAMOTO (Sci. Rep. Tôhoku, 1938, **27**, 155—158).—X-Ray examination of well-annealed alloys of Cu with 4—7% Si has confirmed the existence of a hexagonal κ-phase between the α- and γ-phase fields; prolonged heating at 350—400° causes κ to decompose into α + γ.
A. R. P.

Equilibrium diagram of the copper–antimony system. II. Constitution of copper-rich antimony-copper alloys. N. SHIBATA (Sci. Rep. Tôhoku, 1938, **27**, 189—205).—The system has been examined up to 18% Sb by differential dilatometric measurement and by micrographic examination. The eutectic horizontal is placed at 645°, the peritectoid reaction α + β → η at 488°, and the eutectoid reaction η → α + δ at 400°. Cu dissolves 10·4% Sb at 645°, 7·6% at 488°, 6·2% at 400°, and 4·7% at 20°.
A. R. P.

Solid solutions of indium and lead. S. VALENTINER and A. HABERSTROH (Z. Physik, 1938, **111**, 212—214).—An explanation of certain discrepancies between the work of Ageev and Ageeva (A., 1936, 1193) and the authors (A., 1938, I, 612).
L. G. G.

X-Ray investigation of the iron–chromium–silicon phase diagram. A. G. H. ANDERSON and E. R. JETTE (Trans. Amer. Soc. Met., 1936, **24**, 375—418).—Data are recorded for the equilibrium relations between the α-phase and the three binary phases Fe_3Si_2, Cr_3Si, and FeCr, and α-phase boundaries of these phases at 600°, 800°, and 1000°.
CH. ABS. (e)

Solubility of gases in liquids.—See B., 1939, 112.

Solutions of non-polar substances. J. H. HILDEBRAND (J. Physical Chem., 1939, **43**, 109—117).—Data for the solubility of I_2 in CCl_4 between 80° and 100°, combined with earlier data for lower and higher temp. ranges, have been applied to the author's solubility equation, $RT \log_e (a_2/N_2) = v_2 V_1^2 D^2$ where a_2, v_2, and N_2 are the activity, mol. vol., and mol. fraction respectively of I_2, V_1 is the vol. fraction of CCl_4, and D is a parameter. The decrease of D with increase in T, which expresses the deviation from ideal behaviour, is linear and shows no effect ascribable to clustering near the crit. solution temp. The deviation from Raoult's law of the v.p. data for CCl_4 solutions of OsO_4 is approx. that expected from the internal pressure difference of the components. V.p. data for hexadecane solutions of C_6H_{14} obey Raoult's law. F.p. data for the system I_2–$TeCl_4$ indicate that the solutions are not ideal, the f.p. lowering of I_2 being > theoretical.
C. R. H.

Solubility of water in benzene solutions of ethanolamine oleate. R. C. PINK (J.C.S., 1939, 53—55).—Solutions of ethanolamine oleate in C_6H_6, PhMe, or xylene dissolve appreciable amounts of H_2O (~ 4% at 0·6M.) accompanied by an increase in viscosity. An approx. 5-fold increase in the amount of H_2O dissolved is observed on adding 3—5% of PhOH or o-cresol, the effect showing a sharp max. at that concn.
D. F. R.

Attack of alkaline solutions on glass and its dependence on dissolved ions. I. W. GEFFCKEN (Kolloid-Z., 1939, **86**, 11—15).—An interferometric method of studying the corrosion of glass by alkaline solutions is described. The rate of attack is greatly reduced in presence of small concns. (10^{-4}M.) of K_2SiO_3 and hydroxides of multivalent metals. H_3BO_3 and univalent cations are ineffective.
F. L. U.

Miscibility between iron and manganese oxides. V. MONTORO (Gazzetta, 1938, **68**, 728—733).—Fe_3O_4 and Mn_3O_4 are miscible in all proportions. Mixtures containing 0—66·6 at.-% Mn have a cubic lattice of the spinel type; for higher [Mn] the lattice is tetragonal, the axial ratio increasing from 1 up to 1·155 for pure Mn_3O_4. Mixtures in which the relative [Mn] is 33·3 and 66·6 at.-% correspond with the compounds MnO,Fe_2O_3 and FeO,Mn_2O_3, respectively.
O. J. W.

Mechanism of the distribution between liquid and solid phases. A. POLESSITSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 303—304).—Ra has been used as an indicator of the distribution between liquid and solid phases in the crystallisation, both slow and encouraged by stirring, of supersaturated solutions of $Pb(NO_3)_2$. The distribution of Ra is determined by its time of addition to the solution in accordance with

the theory that equilibrium is attained during the formation of micro-crystals and before the appearance of visible ones.   O. D. S.

Equilibrial distribution between solid and liquid phases. A. POLESSITSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 305—306).—Recrystallisation of crystals of $BaCl_2,2H_2O$ and $Ba(NO_3)_2$ containing small quantities of Ra and obtained by slow evaporation at const. temp. leads to a gradual approach to a Berthelot and Nernst distribution, showing that this distribution, and not that of Doerner and Hoskins (A., 1925, ii, 381), represents true equilibrium.   O. D. S.

Distribution in crystallisations in thin films from the molten state in the presence of added coloured compounds of a colloidal nature. J. SEIGLE (Chim. et Ind., 1939, **41**, 13—27; cf. A., 1938, I, 609).—The various forms of crystallisation observed, and the partition of the colloid between the crystals and liquid in the initial stages of solidification, are described and discussed.   J. W. S.

Absorption of hydrogen and nitrogen by pure iron. K. IWASÉ and M. FUKUSIMA (Sci. Rep. Tôhoku, 1938, **27**, 162—188).—Absorption of H_2 by pure Fe commences at 400° and increases linearly with rise in temp. to the A3 point, at which there is an abrupt increase in the absorption; above this point absorption again is a linear function of the temp. but the slope of the line is greater. Fe begins to absorb N_2 at 650° and there is a remarkable increase in absorption at the A3 point; in the γ field absorption decreases linearly with rise in temp. owing to dissociation of the Fe-N solid solution.   A. R. P.

Adsorption at surfaces with frozen thermal equilibrium of the active spots. E. CREMER and S. FLÜGGE (Z. physikal. Chem., 1938, **B**, **41**, 453—465).—To account for the fact that adsorption can frequently be expressed by the Freundlich isotherm, it is assumed that the surface comprises different types of active centres, each of which obeys the Langmuir isotherm. It is suggested that when some surfaces (e.g., those of oxides of the metals of group III) are heated to a temp. $T_h°$ K. an energy distribution is established of the form e^{-E/RT_h}, which is frozen on cooling. With the assumption that the adsorptive energy is $\propto E$, this leads to an adsorption equation of the observed form in which the exponent $n = T_o/T_h$ ($T_o°$ K. = temp. of observation). The theory is supported by data for the adsorption of EtOH on Nd_2O_3.   J. W. S.

Optical methods of study of molecular adsorption. A. N. TERENIN (Sci. Mem. Univ. Leningrad, 1937, **3**, No. 17, 149—168).—A review.   R. T.

New technique for measurement of adsorption of gases and vapours on solids. H. H. CHAMBERS and A. KING (J.C.S., 1939, 139—143).—The adsorption apparatus consists essentially of a Nicholson hydrometer floating in Hg and carrying the adsorbent in the pan. The hydrometer rises or sinks during adsorption or desorption and the level is read with a cathetometer.   D. F. R.

Adsorption of hydrogen and deuterium on charcoal between 90° and 17° K. W. VAN DINGENEN and A. VAN ITTERBEEK (Physica, 1939, **6**, 49—58).—The adsorption of D_2 is the greater, the difference increasing from 8% to 15% over the temp. range studied. The isotherms can be represented for 90—55° K. by a Freundlich equation, and for 20—17° K. by a Williams equation. The heats of adsorption decrease as the amount adsorbed increases and are independent of temp., being 180 g.-cal. greater for D_2. From capillary condensation data, γ is calc. for D_2 as 1·70, 1·11, 0·81 dyne per cm., at 17·5°, 19·0°, 20·4° K., respectively.   L. J. J.

Adsorption of hydrogen on poisoned nickel. I. Studies at low temperatures. S. IIJIMA (Rev. Phys. Chem. Japan, 1938, **12**, 148—155; cf. A., 1938, I, 510).—Rates of adsorption of H_2 on reduced Ni poisoned with C_2N_2 at −78° and −112° have been determined. The equation for the adsorption velocity of H_2 and D_2 on reduced Ni is applicable to that of H_2 on poisoned Ni. The relation between amount of C_2N_2 poisoning Ni and logarithm of velocity coeff. of adsorption of H_2 is linear. C_2N_2 first poisons the more active parts of reduced Ni.   F. H.

Simultaneous sorption of carbon disulphide and water vapour by activated charcoals. J. L. LIZIUS and A. J. ALLMAND (Proc. Roy. Soc., 1938, **A**, **169**, 25—44).—The investigation was carried out on charcoals activated in three different ways; measurements were made of the adsorption isotherms of CS_2 on charcoals containing a const. charge of sorbed H_2O. The effect of variation in the H_2O charge on the pressure of a const. charge of CS_2 was studied. The results are consistent with previous work on the same charcoals and with the idea that H_2O is sorbed at low pressures as a disperse layer of single and double mols., whilst at higher pressures a continuous film is gradually formed accompanied by irreversible capillary condensation.   G. D. P.

Application of film balance to surface of ordinary solutions. J. W. MCBAIN and L. H. PERRY (Ind. Eng. Chem., 1939, **31**, 35—39).—When an aq. solution of hydrocinnamic acid (I) is kept in a Langmuir–Adam trough, and then its surface is reduced by movement of the barrier towards the float, a pressure is developed on the float, relative to the pressure exerted by the surface behind the float. A similar pressure (0·42 dyne per cm.) is reached when crystals of (I) are placed on H_2O. It is considered that a pellicle of (I) is formed and that at least this pressure is required to cause it to redissolve. Experiments on the change of pressure with time at various initial compressions are described, and data for other solutes are recorded. The bearing of these results on the " depth " of surfaces of solutions is discussed.   F. A. A.

Electrical properties of deposited layers of calcium stearate. P. A. ZAHL, C. P. HASKINS, D. M. GALLAGHER, and C. E. BUCHWALD (Trans. Faraday Soc., 1939, **35**, 308—312; cf. A., 1938, I, 452).—The electrical resistance and capacity of Ca stearate films of various thicknesses ⋗41 mol. layers, deposited on electrodes from monolayers by the method of Langmuir and others (A., 1936, 423), have been determined at 1000 cycles per sec. while in contact with aq. salt solutions. For films in contact with M./264-$CaCl_2$ the mean dielectric const. is 3·7.

Anomalous results are obtained when the films are in contact with aq. $CuSO_4$.   J. W. S.

Rigidity in protein films, and the properties of the force–area curves. J. B. BATEMAN and L. A. CHAMBERS (Nature, 1938, **142**, 1158—1159).— Measurements on surface films of ovalbumin on 0·01 or 0·10M.-HCl with different ratios of wall to surface show that the drag-effect of the walls does not appreciably affect the force–area curves.   L. S. T.

Repulsive forces between charged surfaces in water, and the cause of the Jones–Ray effect. I. LANGMUIR (Science, 1938, **88**, 430—432).— Theoretical. The Jones–Ray effect (A., 1937, I, 126) can be explained on the basis of a H_2O film held on the surface of the capillary tube by electric charges.
          L. S. T.

Observations with small liquid drops. E. RUMPF and E. GEIGL (Z. Physik, 1938, **111**, 301— 313).—The radius of the droplets in mists formed from H_2O and solutions of various substances in varying concn. has been measured. Curves relating relative abundance to drop radius show sharp max. varying with the solute and its concn. Measurements were also made with supercooled mists. Results are discussed.   H. C. G.

Capillary systems with gas–liquid boundary. H. KNÖLL (Kolloid-Z., 1939, **86**, 1—10).—In determining the radius of a glass capillary tube by the max. bubble pressure method the val. obtained is always < the true val., and decreases with increase in length of the tube. The val. calc. from the pressure at which bubbling ceases as the pressure is lowered coincides with the true val. and is independent of the tube length. Methods of testing the pore size and uniformity of glass fritted filters, for which the max. bubble pressure method is unsuitable, are discussed.
          F. L. U.

Surface-active agents. F. E. BARTELL (Ind. Eng. Chem., 1939, **31**, 31).—Introductory.
          F. A. A.

Surface-active properties of hexametaphosphate. G. B. HATCH and O. RICE (Ind. Eng. Chem., 1939, **31**, 51—57).—Small amounts of Na hexametaphosphate $(NaPO_3)_n$ (I) inhibit the formation of Ca soaps when $Ca_3(PO_4)_2$ is shaken with Na oleate solutions. In the "threshold treatment" of H_2O amounts of (I) ≪ that equiv. to the contained Ca are effective; e.g., 2 p.p.m. of (I) added to H_2O containing 200 p.p.m. of $Ca(HCO_3)_2$ obviate pptn. when the H_2O is treated with 500 p.p.m. of Na_2CO_3 or heated at 80° for 1 hr. The uses of (I) under various conditions for H_2O-softening and scale removal are discussed.   F. A. A.

Movement of water from concentrated to dilute solutions through liquid membranes. H. E. BENT (Science, 1938, **88**, 525—526).—F.p. determinations indicate that H_2O + AcOH are associated in guaiacol solution. This association is used to explain the anomalous diffusion of H_2O reported previously (A., 1938, III, 756).   L. S. T.

Porous diaphragm method of measuring diffusion velocity, and velocity of diffusion of potassium chloride in water. II. Determination of the size of paraffin-chain salt micelles from diffusion measurements. G. S. HARTLEY and D. F. RUNNICLES (Proc. Roy. Soc., 1938, **A, 168**, 401—419, 420—440).—I. A continuous reading apparatus for measuring the rates of diffusion of pure electrolytes through porous diaphragms is described. Data for the diffusion of KCl as a function of concn. are given.

II. The method is applied to measure the diffusion of paraffin-chain micelles in aq. solution with excess of a simple electrolyte. For cetylpyridinium salts the radius of the micelle is calc. to be 26 A., and the results are in agreement with the "spherical liquid micelle" theory. The method fails for cetanesulphonates and cetylsulphates; anomalies which occur when the solutions are saturated with amyl alcohol or C_6H_6 are discussed.   G. D. P.

Diffusion through polished and etched copper surfaces. H. CRAMER (Ann. Physik, 1939, [v], **34**, 237—249).—The diffusion from films of Au, Ag, and Zn deposited by evaporation has been followed by electron diffraction. From 150° to 500° changes are observed in the structure of Au layers, indicating diffusion of Au into Cu with formation of a Au–Cu alloy. No difference in this effect was observed between polished and etched Cu, except for films < 2 mμ. thick, when diffusion begins at lower temp. for etched than for polished Cu. No diffusion of Ag into Cu was observed between 20° and 500°. No diffusion of Zn at temp. < 300° was observed. At 300° Zn becomes oxidised and exchange takes place between Zn and Cu atoms, which is complete at 400°. The observations of Finch et al. (A., 1934, 134) of the diffusion at room temp. of Zn into Cu etc. are not confirmed.
          O. D. S.

Diffusion behaviour and porous structure of iron oxide. G. GRAUE and N. RIEHL (Angew. Chem., 1939, **52**, 112—114).—ρ for various specimens of Fe_2O_3 as determined under xylene varies from 2·6 to 5·3, so that it contains pores of at. dimensions. Specimens with co-pptd. Ra-Th which have not been heated give up almost all of the Em, but on heating the evolution of Em falls off to a min. at ~ 600° due to closing of the pores, and then increases again due to thermal diffusion. Ignited specimens give up very little Em at <600°. The determination of ρ for active Fe_2O_3 by the Em method is impracticable because of adsorption. Specimens previously heated to 250° gave the same val. (4·3—4·35) for ρ by the Em method as under xylene.   F. J. G.

R. S. Krishnan's reciprocity law of colloid optics. V. S. VRKLJAN (Proc. Indian Acad. Sci., 1938, **8, A**, 353—355).—Theoretical.   W. R. A.

Diffusion and fall of atmospheric condensation nuclei. J. J. NOLAN and P. J. NOLAN [with appendix by P. G. GORMLEY] (Proc. Roy. Irish Acad., 1938, **45, A**, 47—63).—Vals. obtained by Nolan and Guerrini (A., 1936, 425) are recalc., giving D 12 × 10^{-6} sq. cm. per sec. and velocity of fall V_g 15 × 10^{-5} cm. per sec. for nuclei confined over H_2O. Over oil D is 20 × 10^{-6} sq. cm. per sec. The corresponding radii are calc. as 3·55 and 2·68 × 10^{-6} cm., respectively. The nature of changes occurring in

stored nuclei is uncertain. Coeffs. for diffusion through a rectangular slit are calc.   L. J. J.

Nature of foam. II. Foam formation of the ternary system acetic acid–ethyl ether–water. T. SASAKI (Bull. Chem. Soc. Japan, 1938, **13**, 669—678).—The mutual solubility curve divides the foam formation diagram into homogeneous and heterogeneous regions, all systems in the former region frothing. Exceptional frothing power is shown by AcOH 2·7, Et_2O 4·0, H_2O 3·3 by vol. The heterogeneous region is divided into foamy and non-foamy regions depending on the relative vols. and surface tensions of the two layers. Typical examples of such systems are considered.   C. R. H.

Magnetisation of ferromagnetic colloids. W. C. ELMORE (Physical Rev., 1938, [ii], **54**, 1092—1095; cf. A., 1938, I, 572).—The magnetisation curves of colloidal magnetite (Fe_3O_4) and colloidal siderac (γ-Fe_2O_3) determined by a null method for fields of 0—4000 gauss agree with a theoretical curve based on certain specified assumptions. The average particle moment is $5·2 \times 10^{-16}$ for the magnetite sol and $7·4 \times 10^{-16}$ for the siderac sol.   N. M. B.

Mechanism of the aggregation of silicic acid from sodium silicate solutions. I. The silicic acid of low mol. wt. stable in acid solution. II. Structural observations. A. R. TOURKY (Z. anorg. Chem., 1939, **240**, 198—208, 209—216).—I. The aggregation of silicic acid from acidified Na_2SiO_3 solutions, in its dependence on p_H and time, has been studied by ultrafiltration. On addition of HCl polymerisation begins at p_H 10·85, and is most rapid at the neutral point, the rate then decreasing until at p_H 2·8 only 8% of the acid is colloidal after a day. In more strongly acid solution the rate of polymerisation again increases. The suggestion (A., 1932, 124) that acidified solutions contain a pseudo-form of silicic acid is not necessary; the course of the reaction on acidification does not involve redissolution of SiO_2 polymerised at the neutral point, but represents stabilisation by the added acid of a silicic acid of low mol. wt. before it can polymerise. The stabilising effects of HCl and H_3PO_4 are $\gg$ that of HNO_3. The stabilisation is to be attributed to the formation of a complex with the added acid, the formation of a hetero-polyacid with H_2MoO_4 being an extreme case of this. The view is supported by observations on Λ and on the potential of a calomel electrode in Na_2SiO_3 solutions acidified with HCl.

II. SiO_2 deposited from dil. ultrafiltrates containing a stabilising acid (HCl, $HClO_4$, H_3PO_4) has a fibrous structure, whereas in other cases it is flocculent. The difference is not due to a greater rate of polymerisation in the alkaline media. With conc. solutions there is no difference in the appearance of the ppts., but in presence of a stabilising acid there is a continuous increase of vol. during the process of aggregation which is not found otherwise. This indicates that the fibrous structure results from chain formation, with elimination of H_2O, by active H_2SiO_3 mols. liberated by the decomp. of complexes formed with the stabilising acid.   F. J. G.

Alkali soaps of naphthenic acid.—See B., 1939, 169.

Pasting of starch. I. Photoelectric and ultramicroscopic analysis of pasting. II. Thermometric and conductometric measurements on starch suspensions during pasting. A. KÜNTZEL and K. DOEHNER (Kolloid-Z., 1939, **86**, 124—130, 130—134).—I. The absorption of light by starch suspensions during heating shows a marked increase at a definite temp. (θ_1) and begins to decrease at a higher temp. (θ_2). Parallel ultramicroscope observations show that the pasting process occurs in two stages, viz., a loosening (fusion) of the crystallites at θ_1, followed by hydration (swelling and dissolution) of the released mols. at θ_2.

II. Heating curves indicate clearly an absorption of heat (latent heat of fusion) at θ_1, and less clearly an evolution of heat (heat of swelling or dissolution) near θ_2. The latter change is accompanied by a sudden increase in electrical conductivity.   F. L. U.

Relation between constitution of cellulose and its physical properties.—See B., 1939, 132.

Solubility of cellulose wools in sodium hydroxide solutions and its dependence on fine structure of the fibre.—See B., 1939, 133.

Mechanism of deformation and fine structure of hydrous cellulose. V. " Mechanical properties " of hydrous cellulose. P. H. HERMANS [with J. DE BOOYS and D. VERMAAS] (Kolloid-Z., 1939, **86**, 107—123; cf. A., 1938, I, 311).—The results of experiments showing the influence on the force-extension (F–E) curves of preorientation produced by extending partly swollen fibres are discussed in conjunction with data presented in previous papers of the series. Comparison between F–E curves for cellulose and those for other substances (e.g., rubber) is permissible only if the micellar orientation is similar in both. The course of the F–E curves observed with fibres of regenerated cellulose having graded orientations is explained, and an interpretation of yield points is offered.   F. L. U.

Mechanism of deformation of hydrous cellulose. VI. Tensile strength of fibres and energy involved in the process of rupture. P. H. HERMANS (Rec. trav. chim., 1939, **58**, 63—76).—Discussion of the properties of an " ideal fibre," for which the theoretical extensibility (E) and tensile strength (T) have been calc., leads to the conclusion that such a fibre has little in common with actual fibres, for which both E and T are much smaller. It is shown that, whatever may be the actual mechanism of rupture, the work done (w) in extending fibres to the point of rupture is sufficient to break the mol. chains and to reduce considerably the average chain length. Measurements of T and w for fibres of various kinds (isotropic, prestretched, dry, wet) are recorded.   F. L. U.

Solubility of gluten.—See B., 1939, 203.

Behaviour of microscopic bodies consisting of biocolloid systems and suspended in an aqueous medium. III. Coacervation phenomena in droplets of biocolloid sols enclosed in a

L (A., I.)

collodion film. Accumulation of basic dyes. H. G. Bungenberg de Jong and O. Bank (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 83—88).—If drops of a sol mixture of gelatin, prepared by methods involving acid or alkaline reactions, which are described, and gum arabic are enclosed in a collodion film on a glass slide which is then immersed in dil. aq. AcOH, complex coacervation is easily observed microscopically. A collodion film containing drops of 5% gum arabic absorbs basic dyes from their dil. solutions, and the dye accumulates in the enclosed solution. This phenomenon is explained on the principle of Donnan equilibrium as due to exchange of cations of the gum arabic (chiefly $Ca^{..}$) with dye cations. If the dye cation concn. in the gum arabic solution is $>$ a crit. val., coacervation of the gum arabic takes place.
W. R. A.

Emission of ultra-violet radiation during coagulation. A. Rabinerson and M. Philippov (Compt. rend., 1939, 208, 35—37).—The coagulations of $Fe(OH)_3$ by N-Na_2SO_4, and of V_2O_5 and Na oleate by 0·5N-KCl, are accompanied by the emission of ultra-violet radiation of $\sim$2000 A., detected both by photo-electric counter and by biological methods. With the latter method there is an induction period and the radiation emitted during coagulation is identical with mitogenetic radiation.   W. R. A.

Dielectric studies of the action of organic solvents on high-molecular substances. I—III. W. L. H. Moll (Kolloid-Beih., 1939, 49, 1—42, 42—60, 60—74; cf. A., 1936, 1461).—I. ρ, n_D, ϵ, and surface tension (γ) have been measured for 64 org. liquids, the solvent action of which on cellulose derivatives, rubber, synthetic resins, brucine, NBu^a_4I, and $HgCl_2$ has been studied. If the solvents are shown on a rectangular diagram in which vals. of γ are ordinates and vals. of the dielectric function μ^2/ϵ (μ = dipole moment) abscissæ, the solubility relations of each solid are represented by an inner closed curve, the solvents within which effect complete dissolution. This region is surrounded by a zone in which only swelling occurs, and outside of which no action is observed.

II. An estimate of solvation is obtained from dielectric measurements on solvents and solutions. Solvations of 1—3 mols. per glucose unit are found for benzylcellulose and cellulose acetate, and $\gg$1 per monomeric unit for Me polymethacrylate.

III. Calculations from available data show the existence of stoicheiometric solvates in the case of cellulose derivatives, and indicate its probability in the case of other macromol. substances. Swelling and dissolution can be explained qualitatively on the basis of dielectric properties.   F. L. U.

General function between viscosity and particle size. E. A. Hauser and D. S. le Beau (Kolloid-Z., 1939, 86, 105—107).—With 1% suspensions of bentonite having particles of known diameter (10—200 mμ.) η decreases with increasing particle size to a limit at $\sim$50 mμ. The high val. of η observed, especially with the finest suspensions, is attributed to a high degree of hydration.
F. L. U.

Viscosity of rubber solutions.—See B., 1939, 181.

Thixotropy and viscosity. C. F. Goodeve (Trans. Faraday Soc., 1939, 35, 342—358).—Existing data and theories concerning thixotropy are summarised and discussed, and it is concluded that only a " scaffolding " structure explains all observations. Non-Newtonian viscosity may be regarded as comprising two independent parts, one Newtonian and the other thixotropic, the latter being attributed to interference between particles and the formation of links. When stretched and broken the links cause a series of impulses from a moving layer to a neighbouring layer, the amount of each impulse being $\propto 1/v$ (v = rate of shear), and the frequency of impulses is $\propto v$. Thus the product, the total force due to links, is independent of v. The difference between Newtonian and thixotropic viscosities, and the behaviour of various thixotropic systems, are discussed from the viewpoint of this theory.
J. W. S.

Comparison of the influence of audible sound and of ultrasonic waves on colloidal and two-phase systems. H. Freundlich and D. W. Gillings (Trans. Faraday Soc., 1939, 35, 319—324).—The relative effects of ultrasonic waves of frequency (n) 214×10^3 cycles per sec. and of audible sound waves (n = 5000 and $\sim$400 cycles per sec.) in the degassing of liquids, production of oil–water and metal–water emulsions, liquefaction of thixotropic gels, reduction of viscosity of colloidal solutions, coagulation of colloids, and fog formation have been compared qualitatively. Progressive decrease in effect is observed with decreasing n. Cavitation is effective at 5000 cycles, and causes the production of dispersions similar to those produced by ultrasonic waves.   J. W. S.

Effect of ultrasonic waves on colloid phenomena. V. Influence on thixotropy. I. Thixotropic systems with aluminium hydroxide. N. Sata and N. Naruse (Kolloid-Z., 1939, 86, 102—105; cf. A., 1938, I, 78).—The time of setting (t) of thixotropic $Al(OH)_3$ sols increases with their age, becoming const. in 1—2 weeks after their prep. It also depends on the total duration of shaking and on the no. of transformations which they have undergone. The liquefying action of ultrasonic waves differs from that produced by shaking in that the micelles are broken down to smaller units, thus leading to a different distribution of adsorbed H_2O and electrolytes. Rise of temp. shortens t.
F. L. U.

Orientation of suspended particles in an ultrasonic field. J. J. Hermans (Rec. trav. chim., 1938, 57, 1359—1372; cf. A., 1938, I, 247, 619).—The orientation of discs of " pearl essence " and mica, having radius $\sim$10^{-3} cm., in H_2O was determined by measuring the reflected light by a photo-electric cell. The amount of orientation increases rapidly with increasing energy of the sonic field but at sonic energies $<20 \times 10^{-4}$ w. per sq. cm. the orientation is $<$ expected. At such low energies Reynolds no. becomes $\ll$1, showing that friction plays a predominant part in the motion of the particle, a conclusion verified by the more pronounced deviations

obtained at low sonic energies in the orientation of mica particles in glycerol–H_2O mixtures where the internal friction is large.　　　F. H.

Electrokinetic potential. III. Mechanism of formation of dipole double layer and interpretation of Coehn's rule. IV. Electrokinetic potential of sulphur against alcohols. K. KANAMARU and T. TAKADA (Kolloid-Z., 1939, **86**, 77—86, 86—93; cf. A., 1938, I, 396).—III. Theoretical. The formation of ion–dipole and dipole–dipole layers is discussed with reference to a solid in contact with an org. liquid. With liquids belonging to any one homologous series the ζ-potential is given by the empirical formula $a(\epsilon_1 - \epsilon_2)(\mu/v)^b/\epsilon$, in which ϵ_1 and ϵ_2 refer to the liquid and solid respectively, μ is the dipole moment, v the mol. vol. of the liquid, and a and b are consts. Coehn's rule is not valid when one of the phases is non-polar, but is qualitatively true when both are polar.

IV. Streaming potentials of H_2O and a series of alcohols in contact with S were measured at 20°. The calc. ζ-potential of S decreases with increasing length of the C chain, except for MeOH. The results agree well with the above formula.　　　F. L. U.

Streaming potential and surface conductivity. III. A. J. RUTGERS and E. VERLENDE (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 71—78; cf. A., 1938, I, 573).—Theoretical. The electrokinetic potential ζ at surfaces in contact with electrolytic solutions can be calc. as a function of concn. c; ζ–log c curves are straight lines with a slope of 58 mv. This hypothesis agrees satisfactorily with observed facts.　　　W. R. A.

Capillary systems. $XXII_1$. Effectiveness of methods of purification (filtration, dialysis, electrolysis, and their combinations). E. MANEGOLD and K. KALAUCH (Kolloid-Z., 1939, **86**, 93—101). —A general formula connecting the degree of purification of a sol (concn. of electrolyte) with time, applicable to filtration, dialysis, electrolysis, and any combination of these, is derived. The experimental conditions determining the relative effectiveness of these processes are discussed.　　　F. L. U.

Equilibrium dissociation and thermodynamic constants of nitrosyl chloride. Comparison with spectroscopic data. C. M. BEESON and D. M. YOST (J. Chem. Physics, 1939, **7**, 44—52).—The equilibrium dissociation $2NOCl_{(g)} = 2NO_{(g)} + Cl_{2(g)}$ has been measured between 100° and 220°. The second virial coeffs. of NOCl gas, calc. from results of pressure–temp. measurements on mixtures of NOCl and NO between 0° and 100°, were used to correct the measured consts. to those for perfect gases. Derived thermodynamical equations for the reaction give: $\Delta G^0_{298} = 9720 \pm 60$ g.-cal., $\Delta H^0_{298} = 18,060 \pm 200$ g.-cal., $\Delta S^0_{298} = 28.0 \pm 0.5$ g.-cal. per degree, and S^0_{298} (NOCl) = 63.0 ± 0.3 g.-cal. per degree. The val. of ΔS obtained experimentally is < that calc. from spectroscopic data on NO and Cl_2 by 3·61 g.-cal. per degree. Agreement can be obtained by increasing the spectroscopic entropy of NOCl by 1·8 g.-cal. per degree. This suggests that an observed infra-red ν at 923 cm.$^{-1}$ is a combination, 633 + 290 cm.$^{-1}$
　　　W. R. A.

Collision factors in solution. R. P. BELL (Trans. Faraday Soc., 1939, **35**, 324—327).—Both kinetic theory and transition state methods lead to the conclusion that the presence of solvent should increase the collision factor for a bimol. reaction 1—4 times, provided the energy of activation is the same in the gas and in the solution. Available experimental data support this val. rather than much higher vals. previously deduced from the transition state method. Both methods predict abnormal collision factors for reactions involving large changes of polarity.
　　　J. W. S.

Determination and calculation of equilibrium constants for isotopic hydrogen exchange in the systems n-amyl alcohol–water and ethylthiol–water. Vapour pressures and Raman spectra of n-amyl deuteralcohol and ethyldeuterothiol. F. W. HOBDEN, E. F. JOHNSTON, L. H. P. WELDON, and C. L. WILSON (J.C.S., 1939, 61—67).—The equilibrium consts. for H–D exchange in the gaseous systems n-C_5H_{11}·OH + HOD $\rightleftharpoons$ n-C_5H_{11}·OD + HOH and EtSH + HOD $\rightleftharpoons$ EtSD + HOH are 0·50 and 0·21 respectively, which agree well with those calc. from mol. energy data. Pure n-C_5H_{11}·OD and 93% EtSD have been prepared and their v.p. determined as differences from the corresponding H compounds. Raman spectra of MeOH, MeOD, EtSH, and EtSD have been investigated.
　　　D. F. R.

Equilibrium constant and heat of reaction for the system acetic acid, ethyl alcohol, ethyl acetate, water. A. A. TOMAGHELLI (Rev. Fac. Cienc. Quím. La Plata, 1937, **12**, 107—111).—The equilibrium const. for the reaction EtOH + AcOH $\rightleftharpoons$ EtOAc + H_2O is 3·78 at 100° and 3·71 at 150°, whence the heat of reaction is ~100 g.-cal.
　　　F. R. G.

Compounds of beryllium nitrate and the alkali nitrates. R. CHAUVENET (Compt. rend., 1939, **208**, 194—196).—Determinations of the heat of mixing, d, and n show the existence in solution of compounds mBe$(NO_3)_2, n$M^{I}NO$_3$ having the following $m : n$ ratios : M^I = NH_4, 2 : 3; Li, 1 : 1 (?); Na, 3 : 1, 9 : 7, 7 : 9; K, 1 : 1; Rb, 1 : 1; Cs, 1 : 1, 5 : 3.
　　　A. J. E. W.

Constitution of cadmium iodide solutions. Complete Raman spectrum of the cadmitetraiodide ion. (MLLE.) M. L. DELWAULLE, F. FRANÇOIS, and J. WIEMANN (Compt. rend., 1939, **208**, 184—186; cf. A., 1938, I, 175).—ν and depolarisation factor data are given for solutions of CdI_2 in H_2O, and in five alcohols with and without added alkali iodide. With high [I'] CdI_2 $\nu\nu$ are not observed, and the existence of a CdI_4'' ion (probably tetrahedral) is demonstrated. A complex containing less I than CdI_4'' probably occurs in the alcohol solutions.
　　　A. J. E. W.

Kinetics of electrolytic dissociation equilibria. G. M. SCHWAB (Z. physikal. Chem., 1939, **183**, 250—254).—Theoretical. Comparison of the observed relationship between the heat of electrolytic dissociation and dissociation const. with the theoretical relationship suggests that both the dissociation and recombination processes occur through an intermediate quasi-mol. of high energy content, probably a

partly dehydrated ion pair of half-life period $\sim 10^{-8}$ sec.   J. W. S.

Dissociation in sulphuric acid with temperature. P. KOTESWARAM (Indian J. Physics, 1938, **12**, 299—304; cf. A., 1938, I, 312).—Raman spectra of H_2SO_4 at 30° and 200° are recorded. Shifts observed in the 558 and 928 lines and an increase in intensity of the 1050 line are attributed to HSO_4'. Similarity of the changes produced by dilution and temp. is interpreted as due to progressive dissociation of the acid into HSO_4' and SO_4''.   J. A. K.

Hydroferricyanic, hydrocobalticyanic, and hydrochromicyanic acids. (MLLE.) J. BRIGANDO (Compt. rend., 1939, **208**, 197—198).—Potentiometric and conductometric titrations show the acids to have equal strengths, 0·01M. solutions being approx. equiv. to 0·03M.-HCl. The strength is thus independent of the central metal atom, as in the case of certain complex bases (A., 1938, I, 403). The strength is also independent of stability, $H_3Cr(CN)_6$ being comparatively unstable.   A. J. E. W.

Conductometric study of the neutralisation and displacement of molybdic acid and precipitation of lead molybdate. J. BYE (Bull. Soc. chim., 1939, [v], **6**, 174—178).—The neutralisation curve for MoO_3 shows two breaks corresponding with $Na_2Mo_4O_{13}$ and Na_2MoO_4. The existence of $Na_2Mo_4O_{13}$ is confirmed by conductometric titration of Na_2MoO_4 with HCl. The product of reaction of $Pb(NO_3)_2$ with Na_2MoO_4 or MoO_3 is $PbMoO_4$.   E. S. H.

Universal buffer for the p_H zone 2.0 to 12.0. T. TEORELL and E. STENHAGEN (Biochem. Z., 1938, **299**, 416—419).—The required p_H is obtained by adding HCl to a solution of Na citrate, borate, and phosphate in aq. NaOH. Details are given. The buffering power, cation content, and surface tension of the solution are const. or approx. const., and between 15° and 25° the buffering power does not vary appreciably with temp.   W. McC.

Acid–base indicators in methyl alcohol. II. Dissociation of triphenylcarbinols in methyl alcohol. I. M. KOLTHOFF and L. S. GUSS (J. Amer. Chem. Soc., 1939, **61**, 16—19; cf. A., 1938, I, 621).—The effect of salts on the colour of penta- and hexamethoxytriphenylcarbinols in MeOH corresponds with that of a system of uncharged base–cation acid. In MeOH the carbinols are present mainly as Me ether. The equilibrium const. of the reaction between the Me ether and H_2O has been evaluated. Vals. for pK_{ROMe} and pK_{ROH} of the carbinols in MeOH have been determined.   E. S. H.

Determination of activity coefficients. A. AIROLA (Svensk Kem. Tidskr., 1938, **50**, 281—283).—Expressions for activity coeffs. and e.m.f. are briefly discussed.   C. R. H.

Thermodynamics of hydrochloric acid in dioxan–water mixtures from electromotive force measurements. VIII. Extrapolations in 82% dioxan mixtures and standard potentials. H. S. HARNED, F. WALKER, and C. CALMON. **IX. Properties of the 82% dioxan mixtures.** H. S. HARNED and F. WALKER. **X. General summary and critique.** H. S. HARNED, J. O. MORRISON, F. WALKER, J. G. DONELSON, and C. CALMON (J. Amer. Chem. Soc., 1939, **61**, 44—47, 48—49, 49—54).—VIII. E.m.f. of the cells $H_2|HCl$ (M.), dioxan (82%), $H_2O|AgCl–Ag$ have been determined at 5° intervals from 5° to 45° and at 0·001 and 0·01M. The dielectric const. of the solvent is ~ 10. The standard potential is given by $E_0' = -0·0413 - 23·7 \times 10^{-4} \times (0 - 25) - 8·80 \times 10^{-6}(0 - 25)^2$.

XI. E.m.f. measurements of the above cells have been extended to cover the acid concn. range 0·001—0·5M. From the results and the standard potentials previously evaluated, the activity coeff., relative partial mol. heat content, and heat capacity have been evaluated.

X. Experimental errors in the foregoing papers are estimated and the results discussed in relation to the extended interionic attraction theory and Bjerrum's theory of ionic association. Equations for the standard potentials of the cells $H_2|HCl$ (M.), dioxan (X), H_2O (Y)$|AgCl–Ag$ in media containing 0, 20, 45, 70, and 80% of dioxan are given.   E. S. H.

Activity coefficients of concentrated solutions of hydrochloric acid with and without added chlorides or sucrose. M. DUBOUX and J. ROCHAT (Helv. Chim. Acta, 1939, **22**, 161—183).—Data are recorded at 25° for the activity coeffs. of HCl, γ, alone and in presence of NaCl, NH_4Cl, and $MgCl_2$. In absence of chloride, γ has a min. val. in 0·36 mol. HCl. Chlorides increase γ, but in conc. solutions of HCl–chloride γ does not appear to depend solely on the ionic strength. Sucrose (I) increases γ slightly, the increase being the same for freshly dissolved (I) and for (I) solutions in which hydration, if any, has ended. For the accurate determination of γ in presence of (I), using a H_2 electrode, H_2 must be passed for several hr. before the measurements, and the Pt-black deposit must be thin and compact.   C. R. H.

Activity coefficients of the undissociated part of weak acids. I. Acetic acid in potassium acetate solutions. W. D. LARSON and W. J. TOMISICEK (J. Amer. Chem. Soc., 1939, **61**, 65—67).—Procedure is described which can be applied to any weak acid of which the Hg_2'' salt is slightly sol. The standard e.m.f. of the electrode $Hg|Hg_2(OAc)_2(s),OAc'$ is $-0·5109$ v. at 25°. The relative activity coeffs. of AcOH mols. in presence of KOAc have been calc.   E. S. H.

Determination of activity coefficients from the potentials of concentration cells with transference. V. Lanthanum chloride at 25°. T. SHEDLOVSKY and D. A. MacINNES (J. Amer. Chem. Soc., 1939, **61**, 200—203; cf. A., 1937, I, 242).—Activity coeffs. have been calc. from potential measurements of $LaCl_3$ concn. cells with transference from 0·0006 to 0·0333M. at 25°. The vals. decrease less rapidly with increasing concn. than is predicted by the interionic attraction theory. Osmotic coeffs. obtained from the results are consistent with recent isopiestic measurements.   E. S. H.

Physical chemistry of amino-acids, peptides, and related substances. XII. Interaction between dipolar ions in aqueous solution. E. J.

COHN, T. L. McMEEKIN, J. D. FERRY, and M. H. BLANCHARD (J. Physical Chem., 1939, 43, 169—188).—Solubility data for l-asparagine and cystine in aq. NH_2-acid solutions have been obtained, and empirical relations have been derived for the activity coeffs. of such solutions. The coeffs. of α-NH_2-acids are >1, and can be described in terms of a salting-out const., K. Large vals. of K are observed in all interactions in which one or both interacting dipolar ions have paraffin side-chains. Where amide and peptide groups are constituents of both dipolar ions, K is negative.   C. R. H.

Vapour–liquid equilibrium. III. Benzene-cyclohexane mixtures. G. SCATCHARD, S. E. WOOD, and J. M. MOCHEL (J. Physical Chem., 1939, 43, 119—130).—The equilibrium has been measured between 30° and 70° and the ρ of the mixtures at 30°. The system is far from regular, the excess entropy of mixing at const. vol. being ∼ half that at const. pressure. It is suggested that the pure components have not completely random orientation and that orientation becomes more random on mixing.   C. R. H.

Measurement of the partial vapour pressure of cyclopentanone solutions. R. VANDONI (Mém. Poudres, 1938, 28, 236—251).—Determinations were made with (1) a modified Swientoslawski ebullioscope, (2) a new type of ebullioscope in which heating the vapour phase at a temp. different from that of the liquid phase is avoided, and (3) with another type to avoid loss in boiling under the high vac. employed. Results are tabulated for mixtures of cyclopentanone (I) with cyclohexane, C_6H_{14}, and C_6H_6. For solutions of (I) in castor oil, the ebullioscope was unsuitable and a method was employed in which a current of dry air was slowly passed over the solution.   W. J. W.

Thermodynamic behaviour of liquid crystalline solutions of sodium palmitate and sodium laurate in water at 90°. R. D. VOLD and M. J. VOLD (J. Amer. Chem. Soc., 1939, 61, 37—44).—V.p. have been measured at different concns. The existence of waxy soap as a separate phase has been confirmed. The activities of Na palmitate and laurate have been calc. for each of the phases in aq. systems at 90°. Possible models of each of these phases are described.   E. S. H.

Comparative method of measuring vapour pressure lowering with application to solutions of phenol in benzene. E. N. LASSETTRE and R. G. DICKINSON (J. Amer. Chem. Soc., 1939, 61, 54—57).—Procedure based on the distribution of a volatile solvent between two non-volatile solutes is described. The accuracy is about 1% in 0·1M. solutions. The concns. of solutions of PhOH or $C_{10}H_8$ in C_6H_6 having the same C_6H_6-v.p. have been determined at 25° and 50°; certain anomalies are traced to polymerisation. The heat of dissociation of $(PhOH)_2$ is approx. 2400 g.-cal. per mol.   E. S. H.

Dissociation of cæsium and lithium platinichlorides. F. PUCHE (Bull. Soc. chim., 1939, [v], 6, 200—204).—Dissociation pressures for the decomp. $Li_2PtCl_6 \rightleftharpoons Pt + 2Cl_2 + 2LiCl$ have been determined at 443—594°. The normal dissociation temp., deter-mined by extrapolation, is 602—603°. Dissociation pressures have been measured for Cs_2PtCl_6 at 570—829°, but rigid conclusions cannot be reached, owing to the volatility of CsCl.   E. S. H.

Thermal dissociation of platinum tetrachloride. J. KRUSTINSONS (Z. Elektrochem., 1939, 45, 83; cf. A., 1938, I, 519).—At the temp. used in the previous investigations the vaporisation of $PtCl_4$ and $PtCl_3$ is so small as not to vitiate the results. A redetermination of the dissociation pressure of $PtCl_2$ with more rapid heating to decrease error due to vaporisation yields results in accord with those of Wöhler and Streicher. The heat of dissociation of $PtCl_2$ is 31,900 g.-cal.   J. W. S.

Acid fluorides of the alkali metals. II. Higher acid fluorides of rubidium, and thermal diagram of the RbF–HF system. K. R. WEBB and E. B. R. PRIDEAUX (J.C.S., 1939, 111—116; cf. A., 1937, I, 145).—The existence of RbF,2HF and RbF,3HF has been demonstrated and an approx. thermal diagram constructed. The compound RbF,3·5HF has been prepared.   D. F. R.

Fusibility of mixtures of pure anhydrous sodium sulphide and sulphate. G. COURTOIS (Compt. rend., 1939, 208, 199—201; cf. B., 1934, 572).—The f.p. diagram shows the existence of a eutectic, m.p. 730°, containing ∼50% of Na_2S.   A. J. E. W.

Fusibility of mixtures of pure anhydrous sodium sulphide and carbonate. G. COURTOIS (Compt. rend., 1939, 208, 277—278).—The equimol. mixture forms a eutectic, m.p. 795°. M.p. data for other mixtures are given.   A. J. E. W.

Binary systems containing arsenic trichloride or 5-chloro-5 : 10-dihydrophenarsazine. N. A. PUSHIN and K. S. HRUSTANOVIĆ (Bull. Soc. Chim. Yougoslav., 1938, 9, 89—96).—The fusion diagrams of the binary systems with $AsCl_3$ suggest the compounds $AsCl_3,NHPh_2$, m.p. 75°; $AsCl_3,3o$-, m.p. 146°, 3m-, m.p. 162°, and $3p$-$C_6H_4Me\cdot NH_2$, m.p. 200°. 5-Chloro-5 : 10-dihydrophenarsazine does not give compounds with $NHPh_2$ or $COPh\cdot CH_2Cl$, but gives a 1 : 5 compound, transition point 38°, with $AsCl_3$.   R. T.

New explanation of the supposed β-phase of the system As–Sb. P. E. WRETBLAD (Z. anorg. Chem., 1939, 240, 139—141 ; cf. A., 1938, I, 447).—It is suggested that the β-phase consisted of mixed crystals of As_2O_3 and Sb_2O_3, and that the reverse transformation at 550° into the ordinary mixed crystals was decomp. of the oxides.   F. J. G.

Existence of the β-phase in the arsenic-antimony system as a reply to P. E. Wretblad. W. TRZEBIATOWSKI (Z. anorg. Chem., 1939, 240, 142—144 ; cf. preceding abstract).—The β-phase cannot consist of oxides, since it is formed in complete absence of air, and the oxide would sublime, not decompose, at 550°.   F. J. G.

Equilibrium studies on ore-forming sulphides. I. R. SCHENCK, I. HOFFMANN, W. KNEPPER, and H. VÖGLER (Z. anorg. Chem., 1939, 240, 173—

197).—The method of isothermal reduction with H_2 at 400° or 500° has been applied to the systems Sb_2S_3–Cu_2S, Bi_2S_3–Cu_2S, Sb_2S_3–PbS, and Bi_2S_3–PbS, where only one of the sulphides is reducible, and also to the systems Sb_2S_3–Ag_2S and Bi_2S_3–Ag_2S, where both are reducible. The system As_2S_3–Bi_2S_3 consists of a series of mixed crystals, and the reduction isothermal shows no abnormalities. *Compounds* of Sb_2S_3 and Cu_2S in the ratios 3 : 2, 4 : 3, 5 : 4, 1 : 1, 3 : 5, and 1 : 2 or 3 are indicated. There are two series of mixed crystals extending from the compositions 5 : 4 to 1 : 1 and 3 : 5 to 1 : 2 or 3. Bi_2S_3 and Cu_2S form *compounds* in the ratios 3 : 1, 2 : 1, 1 : 1, and 2 : 3, the last being the lower limit of a series of mixed crystals extending up to the composition $Bi_2S_3,13Cu_2S$. There is a second series of mixed crystals from 98 to 100 at.-% Cu_2S. Sb_2S_3 and PbS form *compounds* in the ratios 1 : 1 (?), 4 : 5, 5 : 7, 3 : 5, 2 : 5, and 1 : 3, and Bi_2S_3 and PbS in the ratios 1 : 1, 1 : 3, and 1 : 6, and also a series of mixed crystals from 90·7 to 100 at.-% PbS. The remaining two systems are complicated by the equilibrium relationships of the two metals. Sb_2S_3 and Ag_2S form *compounds* in the ratios 1 : 1, 3 : 4, and 1 : 2, and there are two mixed crystal phases of compositions approx. $Sb_2S_3,49Ag_2S$ and $Sb_2S_3,2Ag_2S,31Ag$; there are indications of other phases in the region rich in Ag. Bi_2S_3 and Ag_2S form *compounds* in the ratios 4 : 3, 1 : 1, and 4 : 5, the first two being the limits of a series of mixed crystals. The behaviour of FeS–BaS and FeS–Cu_2S mixtures, and of Cu_2S alone, towards H_2S at 500° has also been studied. Cu_2S takes up excess of S in solid solution. The binary systems show no sign of compound formation. The compounds indicated in this investigation are compared with those occurring as minerals. The equilibrium data may be used to evaluate the heats of reaction between the complex sulphides, but in two specimen instances they are found to be very small.   F. J. G.

Affinity. LXXXV. Systems osmium–phosphorus and ruthenium–phosphorus. W. BILTZ and H. EHRHORN [with K. MEISEL] (Z. anorg. Chem., 1939, **240**, 117—128).—When heated in P vapour at >1000° under pressure, Os forms a *phosphide*, OsP_2 (ρ_4^{25} 8·9—9·2). It is a greyish-black powder, unaffected by air or aq. reagents but attacked by fused alkali. In vac. at >1000° it loses all of its P, and this provides a method for its analysis. At 1190° the dissociation pressure is 8 mm., from which the heat of formation is estimated at approx. 70 kg.-cal. per g.-mol. No other Os phosphides exist. Ru reacts with P vapour at 650—680°, affording a *diphosphide*, RuP_2 (ρ_4^{25} 5·88), which is stable in vac. at 700° but at >900° affords the *monophosphide*, RuP, and this at >1100° dissociates further to a *subphosphide*, probably Ru_2P. These are all very stable to alkaline solutions, and only RuP_2 is partially attacked by aqua regia. Details of a method for their analysis are given. The phosphides and sulphides of the group Fe, Ru, Os are summarised and compared. The X-ray diagrams of OsP_2 and RuP_2 are similar, but differ from that of FeP_2. In the Os and Ru phosphides, the mol. vol. increment for P has the normal val. (10 c.c.) for semi-metallic compounds.   F. J. G.

Phase study of the system citric acid–water. J. L. MARSHALL (J. Proc. Austral. Chem. Inst., 1938, **5**, 383—396).—The transition point between anhyd. citric acid (I) and its monohydrate (II), as determined by the dilatometer method, is 36·5°. The solubilities in H_2O of (I) and (II), and the densities and v.p. of the saturated solutions have been determined at 10—70°. The decomp. pressure of (II) has also been measured at 13—40°. From the results the calc. average heat of hydration of (I) by liquid H_2O over the temp. range 15—35° is 9·3 g.-cal. per g., and the average latent heat of vaporisation of saturated solutions over the temp. ranges 15—35° and 40—70° is —519 and —493 g.-cal. per g. of H_2O, respectively. The average heats of crystallisation of (I) at 40—70° and of (II) at 15—35° are 5·04 and 8·71 g.-cal. per g., respectively.   J. W. S.

Reactions of zirconium tetrabromide in liquid ammonia. E. W. BOWERMAN and W. C. FERNELIUS (J. Amer. Chem. Soc., 1939, **61**, 121—124).—The existence of the equilibrium $3ZrBr_4,xNH_3$ (sol.) $+ yNH_3 \rightleftharpoons 3Zr(NH)_2,7NH_4Br,zNH_3$ (insol.) $+ 5NH_4Br$ is established. Equilibrium is displaced towards the left by low temp., conc. solutions, or high concn. of NH_4Br. At temp. ≮0°, without addition of NH_4Br the reaction occurs almost quantitatively in the right-hand direction. A further equilibrium, $3Zr(NH)_2,7NH_4Br,zNH_3 + mNH_3 \rightleftharpoons 3Zr(NH)_2,nNH_3 + 7NH_4Br$, is displaced towards the right by addition of K or KNH_2. Excess of KNH_2 yields $Zr(NK)_2,sNH_3$, which is extensively ammonolysed at 0° and reacts with NH_4Br to form $3Zr(NH)_2,7NH_4Br,5NH_3$.   E. S. H.

Ion exchange and its applications. G. AUSTERWEIL (Bull. Soc. chim., 1939, [v], **6**, 55—70).—A review.   E. S. H.

System calcium chloride–sodium benzoate–water. A. G. PETE and E. A. DEL CARLO (Rev. Fac. Cienc. Quím. La Plata, 1937, **12**, 13—29).—$Ca(OBz)_2$ separates from solutions containing >1 g. of NaOBz with the equiv. quantity of $CaCl_2,2H_2O$ in 30 c.c. of H_2O. The solubility in presence of varying excess of NaOBz and $CaCl_2,2H_2O$ is recorded. The solubility of $Ca(OBz)_2$ is increased by addition of gum arabic or glycerol.   F. R. G.

Phase-rule study of the mixed soap system sodium palmitate–sodium laurate–sodium chloride–water at 90°. J. W. McBAIN, R. D. VOLD, and W. T. JAMESON (J. Amer. Chem. Soc., 1939, **61**, 30—37).—The phase behaviour of the system has been determined for two const. ratios of Na palmitate : Na laurate. From the results a curve has been constructed, which permits fairly accurate prediction of the phase-rule diagram for any mixture of the two soaps. Corresponding phase boundaries in the mixed soap system occur at [NaCl] much nearer those for Na laurate than for Na palmitate. The least sol. phase of Na palmitate is made as sol. as Na laurate by adding Na laurate to the system.   E. S. H.

Systems alkali oxide–CaO–Al_2O_3–SiO_2–CO_2. VII. Influence of catalysts on the establish-

ment of the calcite–wollastonite equilibrium. C. KRÖGER and K. W. ILLNER (Z. anorg. Chem., 1939, **240**, 273—283).—When mixtures of $CaCO_3$ and SiO_2 are heated at 400—700° the equilibrium pressures are unchanged by the addition of CaF_2 or of NaF. The addition of $CaCl_2$ gave very high pressures at first, but when the gas was pumped off, and the mixture powdered and reheated, the pressures were much lower, although high vals. were obtained again on introducing fresh $CaCl_2$. The effect is due to H_2O introduced by the $CaCl_2$. Finely-divided Pt was without influence except at 600°, when high pressures were obtained which were not reproduced on powdering and reheating. Na_2WO_4 and WO_3 behaved as did $CaCl_2$. The steady equilibrium pressures represent the crystallisation of a Ca silicate from $CaO-SiO_2$ solid solutions, and this is normally Ca_2SiO_4, but H_2O facilitates the crystallisation of $CaSiO_3$.   F. J. G.

Complexes. Application of the double decomposition $(NH_4)_2Mn(SO_4)_2,6H_2O$ + $NiSO_4,6H_2O \rightleftharpoons (NH_4)_2Ni(SO_4)_2,6H_2O$ + $MnSO_4,7H_2O$. M. LEMARCHANDS and L. PÉJU (Bull. Soc. chim., 1939, [v], **6**, 79—83).—The residues obtained by partial and complete evaporation of the mixed solutions have been identified. The stable pair is $(NH_4)_2Ni(SO_4)_2,6H_2O$ + $MnSO_4,7H_2O$. The results are represented in a square diagram.   E. S. H.

Diagram permitting graphical representation of the composition of multiple systems, such as light alloys. C. BENEDICKS (Compt. rend., 1938, **207**, 1398—1400).—A system is represented by a succession of vectors in two dimensions, the directions of which are arbitrarily chosen to represent the nature of the constituents, and the lengths of which are ∝ the proportion of each in the system. A diagram for commercial Al alloys with ⊁8 constituents is given.   A. J. E. W.

Heats of formation. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], **6**, 178—183).—By analysis of published data it is shown that the mol. heats of formation of electrolytes in very dil. solution are additive.   E. S. H.

Thermochemistry of solutions. IV. Heat of dissolution of sodium chloride in methanol–water mixtures. R. L. MOSS and J. H. WOLFENDEN (J.C.S., 1939, 118—120).—The heat of dissolution of NaCl at high dilution in $MeOH-H_2O$ mixtures has been measured and the results indicate that the ionic solvent sheath is composed primarily of H_2O, although MeOH is not excluded from the sheath except when $[H_2O]$ is comparatively high.   D. F. R.

Influence of saligenin (*o*-hydroxybenzyl alcohol) and its 5-methyl derivative on the electrical conductivity of boric acid. J. BÖESEKEN [with J. H. GONGGRIJP and A. E. A. VAN RHIJN] (Rec. trav. chim., 1938, **57**, 1356—1358). The conductivity of H_3BO_3 is increased considerably by $o\text{-}OH\cdot C_6H_4\cdot CH_2\cdot OH$ (I); *e.g.*, that of 0·5M-H_3BO_3 solution (29) is increased by 0·25 mol. of (I) in H_2O (7·6) to 304 (all in mho × 10⁶). The 5-Me derivative of (I) only slightly increases the conductivity of H_3BO_3. It is suggested that in a large no. of mols. of (I), the two OH are in a favourable position for B complex formation. Introduction of a 5-Me group into (I) has an unfavourable influence on this position of the OH groups. (I), m.p. 83°, is prepared from $o\text{-}OH\cdot C_6H_4\cdot CHO-EtOH$ and 1 mol. of H_2 at ∼30 atm. in presence of PtO_2-FeCl_2; its 5-Me derivative, m.p. 105—106°, is obtained from CH_2O and *p*-cresol.   A. T. P.

Influence of 1 : 8-dihydroxynaphthalene on electrical conductivity of boric acid. J. BÖESEKEN [with J. A. DE BRUIN and W. E. VAN RIJSWIJK DE JONG] (Rec. trav. chim., 1939, **58**, 3—7; cf. preceding abstract).—The conductivity of aq. H_3BO_3 is greatly increased by the addition of 1 : 8-$C_{10}H_6(OH)_2$ (I), the effect being ≫ with the corresponding 1 : 2- and 2 : 3-derivatives. An explanation is given in terms of the relation between the distance between the O atoms in (I) and that between B and O in the H_3BO_3.   F. L. U.

Hittorf transference numbers of sodium and ammonium acetates in anhydrous acetic acid. W. C. LANNING and A. W. DAVIDSON (J. Amer. Chem. Soc., 1939, **61**, 147—150).—Cation transference nos. for 0·16—2·4M-NH_4OAc vary from 0·49 to 0·449. Similar determinations for 0·3—0·9M-NaOAc vary from 0·48 to 0·41. The interpretation of the data in terms of the hypothesis of triple ion formation is discussed.   E. S. H.

Glass electrodes. L. KRATZ (Kolloid-Z., 1939, **86**, 51—54).—Jena glass electrodes having a resistance of 0·3—0·6 MΩ. at 20° are described. They are chemically resistant, give a linear $V-p_H$ relation in the range p_H 1—10, and since they show no appreciable polarisation when loaded with 20—100 mv. for 4 min. they may be used in a simple potentiometer circuit with an ordinary galvanometer.   F. L. U.

Influence of conditions of measurement, particularly of temperature, on the resistance of glass electrodes. H. SAECHTLING [with H. RICHTER and H. G. ROSENTHAL] (Z. Elektrochem., 1939, **45**, 79—82).—At const. temp. the resistance of a glass electrode is const. and independent of the p_H of the solutions in contact with it over the p_H range 1·5—7·0. It decreases rapidly with rise of temp. according to the law $R_2 = R_1 \times 10^{-a(T_2 - T_1)}$, where a is a const. and R_2 and R_1 are the resistances at temp. T_2 and T_1, respectively. For 4073^{III} glass $a = 0·0358$ over the temp. range 20—50°. The vals. of R and a are changed rapidly by conditions leading to attack on the glass.   J. W. S.

Elimination of the diffusion potential. A. AIROLA (Svensk Kem. Tidskr., 1938, **50**, 278—280).—If the Henderson formula for $V_1 - V_2$ is expanded as a series, and if a val. 0·5 is assigned to the const. in the first term of the series, the expression, $V_1 - V_2 = 0·5 \log c_1/c_2$, gives vals. in fair agreement with experimental vals.   C. R. H.

Diffusion potentials in electrolytic mixtures. I. The formula of Henderson. J. J. HERMANS (Rec. trav. chim., 1938, **57**, 1373—1384).—Theoretical. The fundamental difference between an artificial series of solutions and a diffusion layer of similar structure constitutes an objection to the use of such series in comparing their e.m.f. with the p.d. of "free" diffusion. With mixtures of HCl and KCl in

H_2O, calculation shows that no general linear relation exists between u and v during free diffusion, thus depriving Henderson's formula of its foundation.
F. H.

Diffusion potentials in electrolytic mixtures. II. Concentrated KCl/dilute HCl. J. J. HERMANS (Rec. trav. chim., 1939, **58**, 99—106).—Using the differential equations of free diffusion, a formula is derived connecting the diffusion potential (V) between aq. KCl of concn. c_1 and aq. HCl of concn. c_2 with the val. of c_2/c_1. Vals. of V calc. by Henderson's formula decrease too rapidly with decreasing c_2/c_1, being 2 mv. too low at $c_2/c_1 = 0.01$. The use of a KCl bridge is satisfactory only when errors of a few mv. are unimportant. With very conc. KCl errors of 10% or more may occur in the calc. V owing to the non-ideal character of the solutions.
F. L. U.

Galvanic cells with composite electrodes. V. ČUPR and O. KOUTNÝ (Publ. Fac. Sci. Univ. Masaryk, 1938, No. 262, 3—17).—Galvanic cells which simulate the " local cells " assumed in explaining corrosion and passivity phenomena are studied by an arrangement in which the potentials of two cells with Cu–Zn electrodes of variable surface area, which together represent the composite electrode postulated in the corroding metal, can be measured against that of an auxiliary Cu–Zn cell. The e.m.f. of the composite cell is measured for zero current, and the currents in the respective circuits, for $\pi = 0$. From the e.m.f. the polarisation of the electrodes is calc., the measured e.m.f. lying between the val. for Cu and Zn at approx. 0.54 v. except when the ratio of surfaces of Cu and Zn has an extreme val. Both Cu and Zn electrodes are polarised to an extent explicable by the change in cation concn. around the electrodes. The proportionality consts. found experimentally from the measured e.m.f. of composite cells agree with those calc. from the electrode resistances. Similar results are obtained with quinhydrone electrodes. F. H.

Local cells on metallic electrodes. V. ČUPR (Publ. Fac. Sci. Univ. Masaryk, 1938, No. 266, 3—13; cf. preceding abstract).—Mathematical. Expressions are derived for the total potential of a composite electrode, consisting of a metal electrode on which there is a series of local cells, under the influence or not of an external current, for the difference effect on such a metallic electrode when the local cells each have the same e.m.f., and for the resistance of the coating of the electrode in the passive state or the resistance within the pores of the electrode in the active state. That the expression for the difference effect may be confirmed by measurement of the p.d. between the electrode through which external current flows and that free from external current, and of the intensity of the external current, is evidence of the electrochemical nature of passivity and corrosion phenomena.
F. H.

Cell combinations of silver and platinum in aqueous iodides; electrostatics of the Ag|I′ contact. (MLLE.) S. VEIL (Compt. rend., 1938, **207**, 1388—1390).—The cells Ag|MI(satd.)|Pt (M = Li, Na, K, NH_4, 2M = Ca, Sr, Ba) have a nearly const. e.m.f. (~0.74 v.), I′ having a predominant effect. With 2M = Cd or Zn the effect of the cation is greater

($E = 0.63$, 0.66 v.). The e.m.f. of the cell Ag|KI (satd.)|gelatin|Pt is reduced from ~0.6 to 0.1 v. by interchange of the electrodes, and the cell Ag|KI (satd.)|gelatin|Ag has $E = \sim 0.3$ v.; these results indicate a large fall of potential at the Ag|I′ interface.
A. J. E. W.

Influence of stirring on current–voltage curves obtained with a mercury cathode. S. JOFA and A. FRUMKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 293—296).—Both for an amalgamated Pt cathode and a dropping Hg cathode in $Hg(NO_3)_2 + HNO_3$ solutions, the max. in the current–voltage curve disappears when a vigorous stream of electrolyte is directed against the electrode. O. D. S.

Theories of spontaneous oxidation. A. N. BACH (Acta Physicochim. U.R.S.S., 1938, **9**, 381—394).—A lecture. Recent theories are reviewed and discussed. C. R. H.

Emission spectrum of flame of bromine burning in hydrogen and mechanism of reaction. T. KITAGAWA (Rev. Phys. Chem. Japan, 1938, **12**, 135—147).—The emission spectrum of Br_2 burning in H_2 gives in the range 6875 to 5600 A. about 43 bands of obscure fine structure but with distinct band heads which are analysed. Comparison of the results with those of the absorption spectrum of Br_2 vapour shows that the emission bands are due to the Br_2 mol. the electron transition of which is $Ou^+ \rightarrow {}^1\Sigma_g{}^+$. The excited $Br_2{}^*$ mols. are generated in the chemical reactions occurring during combustion, the following mechanism being proposed : (i) $Br + H_2 = HBr + H$; (ii) $H + Br_2 = HBr^* + Br$; (iii) $HBr^* + Br_2 = HBr + Br_2{}^*$; (iv) $Br_2{}^* = Br_2 + h\nu$; (v) $HBr^* + Br_2 = HBr + 2Br$; (vi) $Br_2{}^* + Br_2 = Br_2 + 2Br$. Reactions (i), (ii), (iii), and (iv) represent the mechanism of the band emission, and (i), (ii), (v), or (i), (ii), (iii), (vi) the mechanism of the branching of the chain reaction.
F. H.

Reaction between oxygen and nitric oxide. E. M. STODDART (J.C.S., 1939, 5—12).—Intensively dried O_2 and NO fail to react only when the gases are mixed in the bulb in which O_2 has been dried; the results are similar whether the gases are dried over P_2O_5 or $Mg(ClO_4)_2$. Addition of H_2O to the non-reactive mixture does not initiate reaction but warming the bulb causes instant reaction. The adsorbed H_2O film is removed from the glass in drying, allowing the surface to adsorb a complete gas film; an O_2 film inhibits the reaction but a NO film does not, the reaction being heterogeneous. The formation of a complex by association of NO mols., with life diminishing with rise of temp., is suggested, the complex being best formed by adsorption of NO on glass. The complex reacts with O_2 giving $N_2O_4 \rightleftharpoons 2NO_2$. When NO is passed into a vessel on the walls of which O_2 is strongly adsorbed the complex is not formed. On warming, adsorbed O_2 is expelled, leaving a surface on which the complex can form and reaction commence.
F. H.

Thermal decomposition of nitrous oxide. R. M. LEWIS and C. N. HINSHELWOOD (Proc. Roy. Soc., 1938, **A, 168**, 441—454; cf. A., 1937, I, 370). —The variation of reaction rate with pressure is

determined at 747° and 652° and is expressed in terms of the reciprocal half-reaction time and of the initial rates. The similarity of the two curves confirms the conclusions previously based on the half-time curve. The mean val. of the activation energy falls at the lower pressures and its magnitude is not in agreement with the theory that the reaction is abnormally slow for certain quantum-mechanical reasons. The influence of the products of the reaction and of added N_2, A, and CO_2 is investigated. At the higher pressures (100—600 mm.) A and N_2 do not contribute much to the activation of the mols.; CO_2 has an effect comparable with that of N_2O itself. At pressures <100 mm. all the gases accelerate the reaction.

G. D. P.

Kinetics of the decomposition of *n*-butane. I. Normal decomposition. L. S. ECHOLS and R. N. PEASE (J. Amer. Chem. Soc., 1939, **61**, 208—212).— Re-investigation of the decomp. (cf. A., 1928, 988) shows that the reaction is more complicated than was formerly supposed. The data agree with the semi-empirical equation $-d(p_{C_4H_{10}})/dt = k_1 p_{C_4H_{10}}^{1.5} + k_2 p_{C_4H_{10}}^2/(p_{C_4H_{10}} - p_{C_4H_{10}})$. The second term indicates inhibition by products, and is eliminated after about 10% reaction; the first term, corresponding with an order of 1·5, predominates over the remainder of the reaction.

E. S. H.

Rôle of peroxides in the oxidation of hydrocarbons. S. S. MEDVEDEV (Acta Physicochim. U.R.S.S., 1938, **9**, 395—420).—Two stable chain processes are evident in the oxidation of hydrocarbons. The first is due to the thermal activation of the original substances and the second to the utilisation of the energy liberated during the decomp. of peroxides. For the first process, the energy of activation, E_1, depends on the nature of the initial hydrocarbon, and the rate, w_1, depends strongly on the temp. For the second process E_2 differs little from the energy of activation of the decomp. reactions of alkyl peroxides. $w_1 \propto c^2$ ($c =$ hydrocarbon concn.); w_2 increases and w_1 decreases with increase in the concn. of peroxide and carbonyl compounds. w_1 is also decreased and, during the first stages, w_2 is increased by an increase in the surface of the reaction chamber. During the oxidation of tetralin (I), (I) H peroxide (II) and tetralone (III) are formed. The addition of (II) increases the oxidation rate of (I), the increase being greater when the (III) content of the original (I) is high. (III) decreases the total oxidation rate.

C. R. H.

Rôle of peroxides in the formation of cold and hot flames of hydrocarbons. M. B. NEUMANN (Acta Physicochim. U.R.S.S., 1938, **9**, 527—580).— Data previously obtained by the author and his co-workers in connexion with many aspects of hydrocarbon oxidation are reviewed and discussed.

C. R. H.

Combustion phenomena of higher hydrocarbons.—See B., 1939, 120.

Thermal stability of butane and *iso*butane.—A., 1939, II, 95.

Chain character of the oxidation of hydrides. N. N. SEMENOV (Acta Physicochim. U.R.S.S., 1938, **9**, 453—474).—The experimental work of Schantaro-vitsch *et al.* is reviewed (cf. A., 1936, 163; 1937, I, 248, 312; 1938, I, 201), and a preliminary attempt is made to give a general theory of the oxidation of hydrides.

C. R. H.

Kinetics of the decomposition reactions of the lower paraffins. E. W. R. STEACIE and I. E. PUDDINGTON (Canad. J. Res., 1938, **16**, B, 411—419). —The limiting high-pressure first-order rate consts. for the thermal decomp. of C_3H_8 from 551° to 602° are given by $\log_{10} k = 13·46 - (63300/2·3RT)$sec.$^{-1}$ The rate consts. fall rapidly with increasing % decomp. and the rate decreases with decreasing pressure. The products of reaction are independent of temp. but are affected by the initial pressure.

D. F. R.

Limits of "cold" inflammation of ethyl ether. L. GUIBIANSKI (Acta Physicochim. U.R.S.S., 1938, **9**, 621—634).—For Et_2O–O_2 mixtures the lower pressure limit, p, decreases with rise in temp. to a min. val. depending on the composition, a further rise in temp. increasing p. The upper pressure limit increases with rise in temp. p depends on the diameter, d, of the reaction vessel so that pd^2 is const. Small quantities of N_2 or CO_2 favour inflammation; larger quantities prevent it. Metal wire spirals, especially Cu and Fe, lower p. The data are discussed.

C. R. H.

Inflammation of gaseous mixtures by the electric spark; air–ethyl ether mixtures. R. VIALLARD (Compt. rend., 1938, **207**, 1405—1408).— The min. potential, V, across a condenser, which causes ignition on discharge through the mixture between given electrodes, is determined. The V–mixture composition curve has a min. at a crit. potential V_c, below which no inflammation can occur. CV_c^x is const., x being dependent on the nature of the electrodes.

A. J. E. W.

Rate of pinacolin isomerisation of two *cis-trans*-isomeric pinacols.—See A., 1939, II, 111.

Ortho–para conversion of hydrogen in diamagnetic liquids. L. FARKAS and L. SANDLER (Trans. Faraday Soc., 1939, **35**, 337—342).—The rate of ortho–para conversion of H_2 and D_2 in solutions in H_2O, D_2O, C_6H_6, CS_2, and CCl_4 has been measured. The conversion is attributed to induced magnetic moments in all liquids, and additional action of nuclear paramagnetism in H and D compounds. With D_2 the transition may take place owing to interaction between the electrical quadrupole and inhomogeneous electric fields.

J. W. S.

Time-law change in formation of chlorate in chlorine bleach liquors. A. SKRABAL (Monatsh., 1938, **72**, 200—212).—The reaction $3OCl' \rightarrow 2Cl' + ClO_3'$ takes place at a rate $\propto [ClO']^3$ when $[Cl']$ is small, and $\propto [ClO']^2$ at higher $[Cl']$. These expressions are shown to be limiting cases of a general rate law: $-d[HOCl]/dt = k_1 k_3 PQ[H^·][Cl'][HClO_3]^3/(k_2[H^·]^2[Cl'] + k_3 Q[HOCl])$, where k_1, k_2, k_3, P, and Q are consts.

E. S. H.

Thermal analysis of second-order reaction. H. MATSUYAMA (Proc. Imp. Acad. Tokyo, 1938, **14**, 343—347).—The measurement of reaction velocity from the change in heat evolved during the progress

of a reaction has been applied to the bimol. reaction between H_2SO_3 and HIO_3 in solution buffered at p_H 4—5. A linear relation is obtained between $1/(d\theta/dt)^{\frac{1}{2}}$ and time, where $d\theta/dt$ is the rate of change of temp. of the system, when the concns. of reacting substances are the same; the velocity coeff. is calc. from the slope. When the concns. of reactants differ, the experimental curve relating $d\theta/dt$ with time coincides with the calc. curve during the early part of the reaction.   F. H.

Thermal analysis of oxidation of sulphites. I. Oxidation of [sodium] acid sulphite by iodate. H. MATSUYAMA (Rev. Phys. Chem. Japan, 1938, **12**, 168—191; cf. preceding abstract).—The velocity equation $-\mathrm{d}[IO_3']/\mathrm{d}t = x[IO_3'][HSO_3'][H^{\cdot}]$ is confirmed by thermal analysis of the reaction between $NaHSO_3$ and KIO_3 in solution buffered by acetate at p_H 4—5. By taking into consideration salt effects the initial reaction $IO_3' + 3HSO_3' + 3OAc' \rightarrow I' + 3SO_4'' + 3AcOH$ is confirmed, Q determined being 159·6 kg.-cal., agreeing with the calc. val. The reaction is not at first bimol. owing to autoxidation of HSO_3' but soon becomes bimol. owing to the catalytic effect of I' produced.   F. H.

Influence of solvent and temperature on the velocity of decomposition of chromic acid. H. C. S. SNETHLAGE (Rec. trav. chim., 1938, **57**, 1341—1350; cf. A., 1938, I, 362).—The initial k of decomp. of CrO_3 in H_2SO_4 solutions becomes $\propto [CrO_3]^2$ as $[CrO_3]$ increases, due to pseudo-unimol. and bimol. reactions being superposed. A bimol. reaction preponderates in high $[CrO_3]$ and low $[H_2SO_4]$, the bimol. k increasing with $[CrO_3]$. In 99·8% H_2SO_4 and in 14% oleum the decomp. is unimol. The ratio (k_{T_1}/k_{T_2}) for initial k increases in all solvents with decreasing $[CrO_3]$. A max. in the curve relating bimol. k with composition of solvent shifts with rise in temp. owing to dependence of E and of Z (of Arrhenius' equation) on the composition of the solvent. The max. in the curve disappears for any temp. at very low $[CrO_3]$ and for any $[CrO_3]$ at sufficiently high temp.   F. H.

Kinetics and mechanism of oxidation–reduction reactions. V. E. STEFANOVSKI and A. M. ZANKO (Acta Physicochim. U.R.S.S., 1938, **9**, 635—648).—Data previously reported on the reduction of $K_2Cr_2O_7$ (A., 1937, I, 246) and $KClO_3$ (A., 1938, I, 204) are reviewed.   C. R. H.

Kinetics of dithionic acid decomposition. III. Influence of solvent. H. STAMM and M. GOEHRING (Z. physikal. Chem., 1939, **183**, 241—249; cf. A., 1939, I, 85).—The decomp. of aq. $H_2S_2O_6$ is accelerated by addition of MeOH, EtOH, Pr^aOH, glycerol, or $COMe_2$, the effect being sp. for each solvent and not attributable to the influence of dielectric const. (ϵ) alone. In accord with Brönsted's theory the activity coeff. of the reacting ions depends qualitatively only on ϵ of the medium and is independent of any sp. properties of the solvent.   J. W. S.

Rate of reaction of methyl halides with halogen ions in methyl alcoholic solution. E. A. MOELWYN-HUGHES (Trans. Faraday Soc., 1939, **35**, 368—374; cf. A., 1938, I, 404).—The kinetics of the replace-ment of Br in MeBr by I, and of I in MeI by Br, have been studied in MeOH solution at 0—50°. The two opposing reactions are each bimol. and are complicated by simultaneous formation of Me_2O. The apparent energies of activation are 18,250±250 and 21,400±1000 g.-cal., respectively.   J. W. S.

Kinetics of the decomposition of trinitrobenzoates in ethyl alcohol. F. H. VERHOEK (J. Amer. Chem. Soc., 1939, **61**, 186—191).—Decomp. of $(NO_2)_3C_6H_2 \cdot CO_2Na$ and $(NO_2)_3C_6H_2 \cdot CO_2Li$ in EtOH at 35—45° is of the first order. Decomp. of $(NO_2)_3C_6H_2 \cdot CO_2H$ (I) in EtOH in presence of NH_2Ph and its derivatives is of the 0·5 order with respect to acid and base when the acid : base ratio is not far different from 1. This behaviour is to be expected if the decomp. substance is $(NO_2)_3C_6H_2 \cdot CO_2'$. The variation of rate of decomp. with strength of base added to (I) in EtOH has been studied. The dissociation const. of (I) in EtOH is $1 \cdot 7 \times 10^{-4}$.   E. S. H.

Thermal study of reactions in solution. I. Method. Types of reactions. P. MONDAIN-MONVAL and R. PARIS (Bull. Soc. chim., 1938, [v], **5**, 1641—1655).—The method, which consists essentially of the measurement of the heat changes during the gradual addition of one of the reactants, and its application to various types of reaction are described in detail.   C. R. H.

Exchange reaction of the hydrogen atoms of the nucleus in phenol. I. Exchange reaction in alkaline solution. M. KOIZUMI and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 681—690).—From data at various temp., the velocity coeff., k, of the reaction $PhOH + HDO \rightarrow C_6H_4D \cdot OH + H_2O$ can be represented by $k = 10^{8 \cdot 7 \pm 0 \cdot 5} e^{-24.800 \pm 800/RT}$ (mol./l.)$^{-1}$, sec.$^{-1}$, and the coeff., k_0, of the reaction $PhO' + PhOD \rightarrow C_6H_4D \cdot O' + PhOH$ is related to k by $k_0 = 10^{2 \cdot 1}k = 10^{10 \cdot 8} e^{-24,800/RT}$ (mol./l.)$^{-1}$, sec.$^{-1}$ C. R. H.

Ageing of precipitates. XXIV. Apparent effect of filtration on the ageing of fresh lead sulphate. Ageing of lead sulphate in excess of lead and of sulphate. XXV. Speed of dissolution of lead sulphate as an indication of the progress of ageing. I. M. KOLTHOFF and W. VON FISCHER (J. Amer. Chem. Soc., 1939, **61**, 191—194, 195—197).—XXIV. The speed of penetration of Th-B through $PbSO_4$ ppts. appears to depend on the conditions of filtration or centrifuging. This effect was shown to be due to a slight co-pptn. of some basic salt with the $PbSO_4$. The speed of perfection and of decrease of sp. surface on ageing decreases with increasing $[Pb^{\cdot\cdot}]$ or $[SO_4'']$ of the medium; excess of $Pb^{\cdot\cdot}$ or SO_4'' has approx. the same effect.

XXV. The speed of dissolution of $PbSO_4$ decreases rapidly with increasing perfection of the crystals, but no evidence of a difference in solubility has been obtained. The solubility of $PbSO_4$ at 25° is $1 \cdot 48 \times 10^{-4}$M. ($\pm 2\%$).   E. S. H.

Polymerisation of chloroprene as revealed by the Raman effect. T. KUBOTA (Bull. Chem. Soc. Japan, 1938, **13**, 678—680).—Raman data for chloroprene (I), solid polychloroprene, and β-chloro-Δ^β-butene suggest that polymerisation of (I) proceeds

linearly to a small extent. In the first stage of the solid state, the larger part of (I) does not polymerise by primary linkings but is held together by van der Waals forces. C. R. H.

Mechanism of catalytic oxidation by molecular oxygen at low temperatures. S. ROGINSKI (Acta Physicochim. U.R.S.S., 1938, **9**, 475—500).— Published work by the author and others on the oxidation of NO on SiO_2 gel, of CO on MnO_2, and H_2 on Pt and Pd is reviewed and possible mechanisms are discussed. C. R. H.

Mechanism of formation of hydrogen peroxide during the explosion and catalysis of "oxyhydrogen." M. V. POLJAKOV (Acta Physicochim. U.R.S.S., 1938, **9**, 517—526).—From a review of data on the explosion of H_2–O_2 mixtures, it is certain that H_2O_2 is the outcome of a vol. process during catalysis and combustion. Of the theories put forward, the Bach–Engler theory appears to give the best explanation of the chain mechanism leading to H_2O_2 formation. C. R. H.

Kinetics of the rearrangement of cis–trans-isomerides in the gaseous state under the influence of foreign gases. B. TAMAMUSHI and H. AKIYAMA (Z. Elektrochem., 1939, **45**, 72—79).— The velocity of the change of Me_2 maleate (I) into Me_2 fumarate in the vapour state has been studied at 270—320° and at pressures of 15—60 mm., with and without the addition of N_2, O_2, or CO_2 (partial pressures 15—60 mm.). The reaction has a quasi-unimol. mechanism, in accord with the Lindemann theory, with a heat of activation of about 17,000 g.-cal. The reaction is accelerated by the presence of foreign gases, under the conditions investigated, the effect of O_2 being > that of N_2 or CO_2. The relative effects may be due either to modification of the binding forces as the mol. of (I) passes through the non-homogeneous magnetic field of the gas mol., or may be a pure activation by collision phenomenon. J. W. S.

Neutral salt action. I. Effect of neutral salts on the velocity of the reaction $2Fe(CN)_6''' + 3I' \rightarrow 2Fe(CN)_6'''' + I_3'$. H. B. FRIEDMAN and B. E. ANDERSON. **II. Effect of neutral salts on the hydrolysis of copper sulphate.** H. B. FRIEDMAN and J. A. STOKES, jun. (J. Amer. Chem. Soc., 1939, **61**, 116—118, 118—121).—I. The velocity of the reaction has been studied in systems of K and Na salts, with and without addition of KCl, NaCl, KNO_3, and $NaNO_3$ in 1, 2, and 3M. solutions. The accelerating influence of K salts is > that of Na salts, and Cl' > NO_3'.

II. Electrometric measurements show that KNO_3, $NaNO_3$, KCl, and NaCl increase the degree of hydrolysis of $CuSO_4$ in the order given, whilst the degree is decreased by Na_2SO_4 and K_2SO_4. E. S. H.

Catalytic influence of hæmins and hæmin derivatives on the luminescence of 3-aminophthalhydrazide. O. SCHALES (Ber., 1939, **72**, [B], 167—177).—The luminescence of the system 3-aminophthalhydrazide (luminol) (I)–H_2O_2 is still perceptible at p_H 5·10. Under identical conditions the initial intensity of the luminescence of (I)–hæmin

(II)–H_2O_2 in aq. Na_2CO_3 is the same at 20° as at 0° but the subsequent decline is much more rapid at the higher temp. Objective measurements of the intensity of luminescense show that C_5H_5N and nicotine increase the luminescence-catalytic activity of (II) and diminish the half-period of the effect. Contrary to expectation, the peroxidatively active phenyl- and p-anisyl-glyoxaline greatly lessen the luminescence and decrease its duration whilst the catalytically active l-histidine, methylglyoxaline, and histamine increase the luminescence-catalytic activity. Mesohæmin (III) causes a more intense luminescence than any hitherto used catalyst. Chlorohæmin (IV) behaves similarly and in aq. Na_2CO_3 gradually loses its activity, apparently in accord with the rate of replacement of Cl by OH. The detection of 1 part of H_2O_2 in 10^8 is possible with (I) and a reagent prepared with (III) or (IV). The initial intensity of the luminescence of o-OH·C_6H_4·CHO–(CH_2·NH_2)$_2$)–$FeCl_3$ is ≪ that of (II), but the duration is very much greater. In very small amounts C_5H_5N increases the luminescence of (I) but in larger quantities it is inhibitive. H. W.

Oxidation of unsaturated hydrocarbons by hydrogen peroxide in presence of pervanadic acid. I.—See A., 1939, II, 95.

Catalytic activity of cubic iron sesquioxide in the synthesis of hydrocarbons by hydrogenation of carbon monoxide at atmospheric pressure. G. LE CLERC (Compt. rend., 1938, **207**, 1099—1101; cf. A., 1937, I, 90).—Carbonates of Na, Li, Rb, and Cs, and $Be(NO_3)_2$ increase the catalytic activity of cubic Fe_2O_3 in the synthesis of hydrocarbons by reduction of CO at atm. pressure, by stabilising the cubic Fe_2O_3 which is more active than Fe_3O_4. The optimum temp. for these new catalysts corresponds with their Curie points. W. R. A.

Action of sulphur in catalytic hydrogenations at high pressure. O. FUCHS and H. BRENDLEIN (Angew. Chem., 1939, **52**, 49—58).—Treatment of MoO_3 with steam and H_2S (1 : 1) at 450° yields a stable catalyst which with H_2 and steam at 450° loses 8% of its S, as compared with 40% for that from Fe_2O_3. The reducing power of such catalysts, particularly those containing Fe, is increased by addition of CS_2. Reduction of n-C_6H_{13}·OH (mixed with H_2O) with 3% of CS_2, at 450°/200 atm., using sulphurised Fe_2O_3,MgO gives 46; Fe_2O_3, 75; MoO_3, 89; Fe_2O_3,Al_2O_3, 94; bauxite, 95; and Fe_2O_3,$2Al_2O_3$, 98% yields of n-hexane. Reduction of aromatic hydrocarbons is hindered by the presence of H_2O, but C_6H_6 with 5% of CS_2, at 460°/300 atm., in absence of H_2O, using a catalyst from Fe_2O_3,$2Al_2O_3$, yields 50% of cyclohexane, whilst $C_{10}H_8$ yields 95% of mixed products. A. LI.

Velocity of catalytic hydrogenation. V. A. KAILAN and O. ALBERT (Monatsh., 1938, **72**, 169—178; cf. A., 1937, I, 470).—k for hydrogenation (Ni) is greater for cinnamates and oleates with an even than for those with an odd no. of C atoms. Entry of m-Cl or m-OH into Ar of CHPh:CH·CO_2Ar (Ar = Ph or tolyl) decreases, whilst that of the o- or p-substituents increases, k. R. S. C.

Raney nickel. I. J. BOUGAULT, E. CATTELAIN, and P. CHABRIER (Bull. Soc. chim., 1938, [v], 5, 1699—1712).—Raney Ni (I) is considered to be a mixture of hydrides, the amount of combined H_2 diminishing with time. (I) catalyses the oxidation of H_2PO_2 to H_2PO_3 and a method of determining alkali and alkaline-earth hypophosphites has been devised. (I) is added to the solution of hypophosphite containing a known amount of N-NaOH, and the excess of NaOH is titrated after 10 min. (1 c.c. of N-H_2SO_4 ≡ 0·88 g. of NaH_2PO_2). (I) can act as a reducing catalyst. If $CHPh:CH\cdot CH_2\cdot CO_2H$ is present during the NaH_2PO_2 oxidation, it is reduced to $Ph\cdot[CH_2]_3\cdot CO_2H$. The hydrogenating and isomerising abilities of (I) have also been demonstrated.   C. R. H.

Catalytic hydrogenation of tar.—See B., 1939, 118, 119.

Recovery of nickel catalyst with sulphuric and sulphonic acids.—See B., 1939, 146.

Formation of an active palladium surface during the oxygen–hydrogen reaction. S. I. ELOVITZ and V. S. ROSING (Acta Physicochim. U.R.S.S., 1938, 9, 501—516).—During the catalytic burning of H_2–O_2 mixtures at a Pd surface the activity of the Pd increases according to $dx/dt \propto (A - x)^n \cdot x$, where x is the amount of mixture consumed expressed as pressure, and A is the original pressure. n varies with the abrupt changes in catalytic and adsorptive properties of the Pd surface which take place during the process. Discrete vals. for n, 0, 0·5, 1·0, 1·5, satisfactorily represent the conditions at various stages of activation.   C. R. H.

Amorphous and crystallised oxide-hydrates and oxides. L. **A three-substance catalyst of ferric, cupric, and magnesium hydroxides as an inorganic ferment of extraordinary efficiency.** A. KRAUSE, L. KWINTKIEWICZOWNA, A. GROCHOWSKA, and Z. TRZECIAKOWSKI (Ber., 1939, 72, [B], 161—167).—The catalyst was prepared by co-pptn. of the three hydroxides; after washing, its composition was Fe : Cu : Mg = 1 : 0·31 : 0·22. Its efficiency in the decomp. of H_2O_2 and the oxidation of HCO_2H by H_2O_2 was > that of any other mixture of the three hydroxides or of any two of them, and was comparable with that of the natural enzymes.   F. J. G.

Catalytic oxidation of paraffin with atmospheric oxygen.—See B., 1939, 120.

Influence of electrolytes on atmospheric corrosion of zinc, aluminium, and iron.—See B., 1939, 159.

Influence of carboxylic acids on corrosion of metals by mineral acids.—See B., 1939, 163.

Electrolysis of molten alkali and alkaline-earth silicates. M. DODERO (Bull. Soc. chim., 1939, [v], 6, 209—218).—Si is formed at the cathode, by secondary reaction of the alkali metal with the melt, when the molten systems Na_2O–SiO_2 or K_2O–SiO_2 are electrolysed. The current efficiency is low, and Si attacks the Fe cathodes. The system Li_2O–SiO_2 yields Li-Si alloys and Li_6Si_2. Melts of SiO_2 with CaO, BaO, or SrO yield alloys of Si with the alkaline-earth metals, containing Si and MSi_2. The prep. of $CaSi_2$ by this method is described.   E. S. H.

Electrolytic production of white lead.—See B., 1939, 173.

Electrolytic production of chlorates.—See B., 1939, 166.

Action of nitrogen on water vapour in the electric arc. M. CENTNERSZWER and Z. KOZUCHOWSKI (Bull. Soc. chim., 1938, [v], 5, 1690—1693).—A 0·06—0·07% yield of NH_4NO_3 and NH_4NO_2 is obtained with Cu or Fe electrodes and a much lower yield with Ni electrodes. The quantities of NH_3 and of N oxides are respectively greater and less with Fe than with Cu electrodes.   C. R. H.

Electrolysis in the glow discharge. IX. **Formation of detonating gas from metastable water molecules.** A. KLEMENC and G. HEINRICH (Z. physikal. Chem., 1938, 183, 217—232; cf. A., 1938, I, 462).—The formation of detonating gas during electrolysis in the glow discharge has been investigated in a spherical vessel which is described. The appearance of metastable mols. in the discharge region is not necessary. The influence of solid partitions in the discharge region has been studied. Metastable H_2O mols. diffuse from the discharge region and dissociate on the partitions to detonating gas. A mathematical treatment of the physical reaction is developed.   W. R. A.

Electrolysis in the glow discharge. X. **Use of alternating current.** A. KLEMENC (Z. physikal. Chem., 1939, 183, 297—317; cf. A., 1938, I, 462, and preceding abstract).—The yields of H_2O_2, $H_2S_2O_8$, and H_2SO_5 obtained on electrolysing 1—10M-H_2SO_4 with an a.c. glow discharge (frequency 50 cycles per sec.) are < those obtained with a d.c. discharge. The difference in mechanism of the reaction in the two cases is discussed, the formation of $H_2S_2O_8$ by a.c. being supposed to occur through combination of two HSO_4 mols. of short life. The results with $KHSO_4$ are similar and are interpreted as indicating the formation of a short-life KSO_4 mol. Solutions of $KHSO_4$ in dil. H_2SO_4 show particularly high yields on a.c. electrolysis by the discharge method.   J. W. S.

Electrolysis in the glow discharge. XI. **Formation and constitution of persulphuric acid and Caro's acid.** A. KLEMENC (Z. anorg. Chem., 1939, 240, 167—172; cf. preceding abstracts).—The formation of $H_2S_2O_8$ and of H_2SO_5 together with H_2O_2 by the glow discharge in H_2SO_4 is interpreted by the following mechanism. Excited H_2O dissociates to H and OH, which then react thus : $H_2SO_4 + H = HSO_4 + H_2$; $H_2SO_4 + OH = HSO_4 + H_2O$; $2HSO_4 = H_2S_2O_8$; $2OH = H_2O_2$; $HSO_4 + OH = H_2SO_5$. This accords with the structures ($\cdot O\cdot SO_2\cdot OH)_2$ and $OH\cdot SO_2\cdot O\cdot OH$ for the two per-acids.   F. J. G.

Synthesis of nitric oxide in a torch discharge. II. K. N. MOTSCHALOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 297—301; cf. A., 1938, I, 260).—The energetic yield increases linearly with pressure up to 3 atm. It is max. for an equimol. mixture of O_2 and N_2. The influence of electrode material and of the size of the torch is discussed.   O. D. S.

Photochemistry of ammonia. H. W. MELVILLE and E. A. BIRSE (Nature, 1938, **142**, 1080).—Measurements of the effect of N_2H_4 on the stationary at. H concn. produced by photo-excited Hg atoms in the photochemical decomp. of NH_3 show that the low concn. is not due to N_2H_4. Except under special conditions, N_2H_4 plays no significant part in the photochemistry of NH_3, and the secondary reactions involve only $H + H \rightarrow H_2$, $NH_2 + NH_2 \rightarrow 2H_2 + N_2$, and $H + NH_2 \rightarrow NH_3$. Only a fraction of the NH_3 mols. undergoes primary dissociation to H and NH_2; the remainder lose their energy by chemically ineffective processes.   L. S. T.

Blackening curve of [photographic] plates in the under-exposure region. T. KIU (Compt. rend., 1938, **207**, 1394—1396).—In the under-exposure region an approx. linear relationship exists between $\Delta D/\Delta t$ and t (D = density of blackened image; t = exposure); photometric interpolation of under-exposed images should be based on this relation. The D/t curve does not pass through the origin, indicating that formation of a latent image does not commence until several quanta have been received by a sensitive centre (A., 1933, 359).   A. J. E. W.

Local sensitivity differences in the layers of photographic plates. O. PAULSEN and A. W. REITZ (Proc. Indian Acad. Sci., 1938, **8, A**, 504—507).—Local sensitivity differences have been estimated in the layers of photographic plates for 8 emulsions. The results have been applied in the determination of the depolarisation ratio in the Raman spectrum.   W. R. A.

Photolysis and extinction coefficients of gaseous carbonyl sulphide. G. S. FORBES and J. E. CLINE (J. Amer. Chem. Soc., 1939, **61**, 151—154).—Extinction coeffs. have been measured over the range λ 226—202·6 mμ. Min. occur at $\lambda\lambda$ 214 and 207 mμ., and max. at $\lambda\lambda$ 225 and 208 mμ., which indicate the importance of transitions not previously recognised. Quantum yields, calc. as mols. of permanent gas evolved per quantum absorbed, varied from 0·5 to 0·7 in initial photolyses, but subsequent photolyses gave vals. >1. The irregularities were traced to retention of CO by COS at liquid-air temp.; after suitable correction the quantum yield was approx. 1. The results correspond with the equation $COS + h\nu = CO + S$. Recombination of the primary products and other secondary reactions involving CO are apparently negligible.   E. S. H.

Production of iodic anhydride by photo-oxidation of organic iodides; photo-oxidation of solid iodoform and carbon tetraiodide. G. EMSCHWILLER (Compt. rend., 1938, **207**, 1201—1203; cf. A., 1938, I, 318).—Small quantities of I_2O_5 have been detected in the photo-oxidation products of CHI_3 and CI_4. With CI_4 production of I_2O_5 is inhibited in a streaming system, suggesting that the I_2O_5 is a secondary product, formation of which is favoured by light. A peroxide-like substance, which gives an I–O compound on decomp., may occur as an intermediate product.   A. J. E. W.

Auto-oxidation of oxalates, and so-called active oxalic acid. B. DAIN, V. BASCHTAVENKO, and A.

SCHWARZ (Acta Physicochim. U.R.S.S., 1938, **9**, 649—664).—The photochemical auto-oxidation of $H_2C_2O_4$ and oxalates in absence of the ions of heavy metals is very slight but is increased by the addition of mineral acids. In the dark, auto-oxidation occurs in presence of $Mn^{..}$, peroxide formation increasing with increase in $[Mn^{..}]$ or p_H. The reaction is characterised by an induction period which is shortened by increasing $[Mn^{..}]$ or p_H. The oxidation is discussed on the basis of chain reactions, and also in relation to the activated $H_2C_2O_4$ observed in photochemical experiments with Éder's solution.   C. R. H.

Photolysis of dimethyl- and diethyl-nitrosoamines and aliphatic amines.—See A., 1939, II, 100.

Reaction investigations with activated solid materials. J. A. HEDVALL (Z. Elektrochem., 1939, **45**, 83—93).—A crit. summary of recent investigations of the effect of mode of formation and of physical state of the reactants on reactions in the solid state, with particular reference to the activation of solid reactions by phase changes in the reactants.   J. W. S.

Preparation of lithium oxide and peroxide. P. PIERRON (Bull. Soc. chim., 1939, [v], **6**, 235—238). —Li_2O_2 is prepared by adding the theoretical amount of H_2O_2 to a boiling, saturated solution of LiOH in EtOH, washing the ppt. with EtOH, and drying over P_2O_5 in vac. Li_2O_2 yields pure Li_2O when heated at 300° in vac.   E. S. H.

Neutral phosphate and hydroxyapatite of lithium. A. A. SANFOURCHE (Bull. Soc. chim., 1938, [v], **5**, 1669—1676).—An extended account of work previously reported (cf. A., 1938, I, 466).   C. R. H.

Preparation of anhydrous sodium sulphide. G. COURTOIS (Compt. rend., 1938, **207**, 1220—1221).—$Na_2S,9H_2O$ is dehydrated over H_2SO_4 or P_2O_5 for 15 days, first at 15°, and finally at 30—35°; the residue is heated at 700° in a rapid H_2 stream. The product, m.p. 1180±10° in a vac., is 99·5—99·8% pure. The heat of dissolution is 15·6 kg.-cal. per g.-mol.   A. J. E. W.

Sodium trisulphide, $Na_2S_3O_{10}$. E. ZINTL and H. ROESSLER (Ber., 1939, **72**, [*B*], 191).—The existence of $Na_2S_3O_{10}$, reported by Baumgarten and Thilo (A., 1939, I, 90) has been established tensimetrically.   F. J. G.

Formation of sodium polyarsenophosphates. A. A. BOMBELLI (Anal. Asoc. Quim. Argentina, 1938, **26**, 121—125).—$Na_2HAsO_4,5H_2O$ (3 mols.) with $NaPO_3$ (2 or 4 mols.) at 600° gives, probably, $Na_{16}(As_2O_7)_3(PO_3)_4$ and $Na_{20}(As_2O_7)_3(PO_3)_8$ respectively, which, unlike a mixture of $Na_4As_2O_7$ and $NaPO_3$, inhibit pptn. of a certain quantity of $BaCrO_4$.   F. R. G.

Reductions by alkali cyanides and their relations with the equilibrium cyanide–cyanamide. A. PERRET and R. PERROT (Bull. Soc. chim., 1939, [v], **6**, 183—190).—The reactions of NaCN with $BiCl_3$, SbI_3, AsI_3, $SnCl_2$, $PbBr_2$, and TlCl at 300—600° have been studied, with particular reference to the formation of cyanamide. The course of the reaction is determined by the stability of the cyanide

first formed by double decomp., by the facility of the cyanide to be transformed into cyanamide, and by the affinity of the metal for N. E. S. H.

Preparation of alkali deuterides and comparison of their dissociation pressures with those of the corresponding hydrides. L. HACKSPILL and A. BOROCCO (Bull. Soc. chim., 1939, [v], 91—103).—The prep. of CsD, RbD, KD, and NaD by direct synthesis is described. The dissociation pressure of these compounds in the approx. temp. range 190—320° is $\gg$ that of the corresponding hydrides. The heats of formation of the deuterides have been calc. E. S. H.

Action of non-aqueous solutions of certain organic acids on metals. R. DUBRISAY and J. J. GOUPIL (Compt. rend., 1938, 207, 1101—1103).—The action of 5% solutions of AcOH in xylene and H_2O on electrolytic Cu wire under varying conditions has been studied. W. R. A.

Dinaphthylthiocarbazone and its intra-complex salts with heavy metals.—See A., 1939, II, 58.

Basic calcium sulphates. R. CURTI (Gazzetta, 1938, 68, 699—702).—The dissociation of pure $CaSO_4$ into $CaO + SO_3$ commences at about 1300°. Chemical and X-ray analyses of the solid products show that during decomp. the basic sulphate $3CaO,2CaSO_4$, but not $CaO,CaSO_4$, is formed. Before decomp. a vitreous modification of $CaSO_4$ is formed. O. J. W.

Chemical and X-ray analysis of dental, mineral, and synthetic apatites. J. THEWLIS, G. E. GLOCK, and M. M. MURRAY (Trans. Faraday Soc., 1939, 35, 358—363).—From the results of chemical and X-ray analysis it is suggested that the apatite present in natural dental enamel consists mainly of $Ca_{10}(PO_4)_6(OH)_2$, with a little Ca replaced by Mg. The C present is probably in the form of $CaCO_3$ or the carbonates of "impurity" metals. Slight variations in lattice dimensions in mineral apatites are probably due to the isomorphous replacement of atoms in the apatite structure. J. W. S.

Formation of hydrated calcium silicates at elevated temperatures and pressures. E. P. FLINT, H. F. McMURDIE, and L. S. WELLS (J. Res. Nat. Bur. Stand., 1938, 21, 617—638).—X-Ray investigation of naturally occurring hydrated Ca silicates indicates that the following are distinct compounds: okenite, $CaO,2SiO_2,2H_2O$; gyrolite, $2CaO,3SiO_2,2H_2O$ (I); crestmoreite, $2CaO,2SiO_2,3H_2O$; xonotlite, $5CaO,5SiO_2,H_2O$ (II); afwillite, $3CaO,2SiO_2,3H_2O$; foshagite, $5CaO,3SiO_2,3H_2O$ (III); and hillebrandite, $2CaO,SiO_2,H_2O$. Others appear to be varieties of these. The formation of cryst. hydrated Ca silicates by the action of H_2O at $\div 500°$ and 480 atm. on Ca silicate ppts. or glasses, or on cryst. anhyd. Ca silicates, has been studied, and artificial (I), (II), and (III) have been obtained, together with cristobalite, wollastonite and pseudowollastonite, $10CaO,5SiO_2,6H_2O$, $2CaO,SiO_2,H_2O$, and $3CaO,SiO_2,2H_2O$, and the new compounds $4CaO,5SiO_2,5H_2O$ and CaO,SiO_2,H_2O, and a new *low-temp. modification* of $3CaO,2SiO_2$, transition

point 1024°. The action of H_2O at room temp. over a period of years on $3CaO,2SiO_2$ and $2CaO,SiO_2$ gave rise to the *compounds* $1·3CaO,SiO_2,1·7H_2O$ and $3CaO,2SiO_2,1·5H_2O$. The bearing of the results on the nature of the cementing material (which could not be isolated) of sand–lime bricks is discussed. F. J. G.

Compounds of zinc nitrate and alkali nitrates. R. CHAUVENET (Compt. rend., 1938, 207, 1216—1218).—Determinations of the heat of mixing, d, and n indicate the existence in conc. solutions of the compounds $mZn(NO_3)_2,nMNO_3$ with the following $m : n$ ratios: M = Li, 9 : 7, 3 : 5; Cs, 5 : 3, 7 : 9; Na, 1 : 1, K, 1 : 1, 1 : 3; Rb, 4 : 3, 3 : 4; NH_4, 1 : 1. A. J. E. W.

Addition products of metallic salts with sulphur and oxygen compounds. J. W. BOUKNIGHT [with G. McP. SMITH] (J. Amer. Chem. Soc., 1939, 61, 28—30).—The production of $[Hg(HgS)](ClO_4)_2$ as an intermediate product in the pptn. of HgS by the action of H_2S on $Hg(ClO_4)_2$ has been confirmed. $[Hg(HgO)](ClO_4)_2,6H_2O$ and $[Hg(HgO)](ClO_4)_2,3H_2O$ have been obtained by dissolving HgO in hot conc. aq. $Hg(ClO_4)_2$. Dithian forms additive compounds with a no. of inorg. salts in suitable solvents; the following *compounds* have been prepared ($X = C_4H_8S_2$): $PtCl_4,2X$, $PtCl_2,X$, $CuCl_2,X$, $CuBr_2,X$, CuF_2,X, Cu_2Cl_2,X, Cu_2Br_2,X, Cu_2I_2,X, $Cu_2(CN)_2,2X$, $Hg(ClO_4)_2,2X$, $Hg(NO_3)_2,X$, $HgCl_2,X$, $HgBr_2,X$, HgI_2,X, $AgClO_4,X$, $2AgNO_3,X$, $AgNO_3,2X$, $CdCl_2,X$, $CdBr_2,X$, CdI_2,X, $PtCl_4,X,C_4H_8O_2$. $Pb(SEt)_2$ has been obtained in pure, stable form; it reacts with conc. aq. $Pb(ClO_4)_2$, forming $Pb(ClO_4)_2,3Pb(SEt)_2$. $AuCl_2(SEt)$ has been prepared from $Au(SEt)_2$ and $HAuCl_3$ in $CHCl_3$. E. S. H.

Thallium metaphosphates. R. CURTI (Gazzetta, 1938, 68, 702—708).—Five different forms of Tl metaphosphate have been prepared. The conditions for their prep. from TlH_2PO_4 and their thermal transformation into one another are described, and solubility and X-ray data are given. Analogies with the Na metaphosphates are discussed. O. J. W.

Lead oxides. II. Hydrous, normal, and active lead monoxides. G. L. CLARK and W. P. TYLER (J. Amer. Chem. Soc., 1939, 61, 58—65; cf. A., 1938, I, 41).—The products of decomp. of $Pb(OAc)_2$ with aq. NH_3 or NaOH have the composition $5PbO,2H_2O$, which is also obtained by dissolving yellow PbO in boiling 8M-NaOH and cooling. X-Ray diagrams of these products have been compared with those of oxides obtained by thermal decomp. of hydroxides and carbonates at different temp. The low-temp. preps. give a highly distorted diagram of red PbO, usually contaminated with yellow PbO; high-temp. preps. give undistorted diagrams of red and yellow PbO, but with $PbCO_3$ the product is undistorted red PbO. The distorted product has an enhanced catalytic activity for H_2O_2 decomp., which can be decreased by "annealing" the specimen, and a greater energy content (1—2%). The distortion cannot be accounted for on the basis of at. displacements by directional stress or thermal agitation resulting from increased energy content of the product; the activity must reside in localised, incompletely cryst. surface areas. E. S. H.

Reaction between nitric oxide and metallic sodium. H. GEHLEN (Ber., 1939, **72**, [*B*], 159—160).—Na does not react with NO at room temp. but ignites at 150—160°, forming a brown substance the aq. solution of which gives the reactions of NO_2' and of hyponitrite. A purer product, pale yellow or almost white, is obtained by using NO diluted with N_2 (1 : 4). It is a *compound* $(NaNO)_x$ different both from Na hyponitrite and from nitrosyl-Na (cf. A., 1933, 578). It dissolves in H_2O with evolution of N_2O, and the solution then contains $Na_2N_2O_2$ and $NaNO_2$ in the ratio 1 : 2 or 3.   F. J. G.

Isomorphous replacement of phosphorus in apatite by silicon and sulphur. R. KLEMENT (Naturwiss., 1939, **27**, 57—58).—Ellestadite, $Ca_{10}Si_3S_3O_{24}F_2$, may be prepared synthetically by sintering a mixture of Ca_2SiO_4 3 mols., $CaSO_4$ 3 mols., and CaF_2 1 mol. at 1200° for several hr. The X-ray powder diagram of the synthetic product is that of an apatite. Mixed compounds which still contain P can be obtained in a similar way, e.g., $Ca_{10}Si_2P_2S_2O_{24}F_2$ from 2 mols. of $CaSiO_4$, 1 mol. of $Ca_3(PO_4)_2$, 2 mols. of $CaSO_4$, and 1 mol. of CaF_2.   A. J. M.

Methods and results of the application of isotopes in chemistry (with the exception of heavy hydrogen). O. REITZ (Z. Elektrochem., 1939, **45**, 100—116).—A review. The methods of concentrating the rarer isotopes of O, N, C, Br, and Cl, and of studying the exchange equilibria of the atoms, are described. The results of utilising ^{18}O and ^{15}N in studying the exchange of O and N atoms between various types of compounds are summarised. The methods of preparing artificial radioactive isotopes of light elements, and their use in the study of kinetic and biological problems, are also summarised.   J. W. S.

Non-stoicheiometric oxides. I. The oxides of chromium. A. CAMERON, E. H. HARBARD, and A. KING (J.C.S., 1939, 55—61).—Decomp. of CrO_3, in a const.-pressure apparatus, occurs in two stages giving two non-stoicheiometric ranges : (I) $CrO_{2.6}$—$CrO_{2.2}$ and (II) $CrO_{1.7}$—$CrO_{1.9}$. Many of the oxides of Cr previously recorded lie in one or other of the ranges. Methods for the prep. of CrO_2 have been investigated. Low-temp. decomp. of $(NH_4)_2Cr_2O_7$ gives an oxide containing N, the composition varying with conditions; the products may be non-stoicheiometric compounds or solid solutions of two or more compounds. $Cr(OH)_3$ heated with O_2 gives an oxide in range (I), decomp. when heating or when boiled with H_2O to an oxide in range (II), CrO_4'' being obtained in the solution. H_2CrO_4 added to $Cr(OH)_3$ gives an oxide in range (II). The only oxides of Cr substantiated are CrO_3, Cr_2O_3, one varying between $CrO_{1.7}$ and $CrO_{1.9}$, and one varying between $CrO_{2.2}$ and $CrO_{2.6}$.   F. H.

Oxidation of chromic oxide by auric oxide hydrate (meta-auric acid). R. LYDÉN (Z. anorg. Chem., 1939, **240**, 157—160).—Ignited Cr_2O_3 is slowly oxidised to CrO_4'' when heated in presence of H_2O with $AuO(OH)$. With Cr_2O_3 in excess the $AuO(OH)$ is quantitatively reduced to Au, but with $AuO(OH)$ in excess the oxidation of the Cr_2O_3 is incomplete. The mechanism of the reaction is discussed.   F. J. G.

Two new molybdic acids. V. AUGER (Compt. rend., 1938, **207**, 1213—1215).—An orange-yellow labile *form* of H_2MoO_4, readily reverting to the white form on treatment with H_2O or dil. acids, is slowly deposited on keeping a solution of MoO_3 in HCl (*d* 1·5—1·6) with 4 vols. of HNO_3 (*d* 1·38) at 35—45°. Dehydration commences at 85° and is nearly complete at 115°. An identical product is obtained by desiccation of yellow $MoO_3,2H_2O$ at room temp. $H_2Mo_2O_7$ (colourless needles, sparingly sol. in H_2O) is prepared by heating white MoO_3,H_2O with 10 parts of HCl (1 vol. conc. HCl + 4 vols. H_2O) at 90—95° for 3 days. The product has a distinct Debye–Scherrer diagram and is not dehydrated at <190°.   A. J. E. W.

Dichlorine hexoxide. M. H. KALINA and J. W. T. SPINKS (Canad. J. Res., 1938, **16**, B, 381—389).—Some chemical and physical properties of Cl_2O_6 are described. The mol. wt. in CCl_4 is confirmed as Cl_2O_6. The extinction coeff. in CCl_4 for λ 5460 is 2·4 compared with that of 80 for liquid Cl_2O_6 for the same λ. A colorimetric method for the determination of Cl_2O_6 is described. Solutions of Cl_2O_6 in CCl_4 are decomposed photochemically by green light with a quantum yield of about 10. Gaseous ClO_3 is decomposed photochemically by λ 3650 and is photosensitised by Cl_2 and Br, the quantum yield with Cl_2 being about 1.   D. F. R.

Affinity. LXXXVI. Affinity of rhenium for arsenic. F. WIECHMANN and M. HEIMBURG [with K. MEISEL] (Z. anorg. Chem., 1939, **240**, 129—138).—Details are given of a high-temp. tensimeter suitable for the study of arsenides, and the following vals. are recorded for the v.p. of As : 62 mm. at 500°, 315 mm. at 571°, and 440 mm. at 590°. Re forms only one *arsenide*, of composition approx. $ReAs_{2.3}$, or Re_3As_7, e_4^{25} 10·8—11·2, heat of formation approx. 3 kg.-cal. per g.-mol. It loses all its As in vac. at 1000°. With reagents it behaves as does Re. The mol. vol. increment for As is 10·5 c.c., agreeing with vals. found for other arsenides.   F. J. G.

Solid solutions of cubic ferric oxide obtained by oxidation of substituted magnetites. J. BÉNARD and G. CHAUDRON (Compt. rend., 1938, **207**, 1410—1412).—The substituted magnetites $Fe_2O_3,(Fe,M^{II})O$ (M^{II} = Mg, Mn) may be oxidised, giving Fe_2O_3 in which part of the Fe is isomorphously replaced by M^{II}. The Curie temp. of the magnetites and their products are studied, and the relative ease of oxidation is discussed.   A. J. E. W.

New ferromagnetic modification of ferric oxide. O. GLEMSER and E. GWINNER (Z. anorg. Chem., 1939, **240**, 161—166).—A detailed account of work already noted (A., 1939, I, 93).   F. J. G.

Complex periodates. I. Cobaltiperiodates. L. MALAPRADE (Bull. Soc. chim., 1939, [v], **6**, 223—235).—Co^{III} forms at least two kinds of complexes with HIO_4: tetracobaltitriperiodates, derived from $H_3Co^{III}I^{VII}_3$, and monocobaltiperiodates of the type $M_2Co^{III}I^{VII}$. The prep. of Na, K, NH_4, Ba, and Ag *tetra-* and *mono-cobaltiperiodates* and the free *acids* is

described. The compositions or constitutions have not yet been determined. E. S. H.

Amminonickelous carbonate. M. GRAND-PERRIN (Bull. Soc. chim., 1938, [v], **5**, 1712—1713).— If Raney Ni be left in contact with a saturated H_2O–EtOH solution of NH_3, unstable violet crystals of $NiCO_3,5NH_3,4H_2O$ (I) are formed which decompose to $2NiCO_3,3NH_3$. (I) can also be formed by passing NH_3 through an ammoniacal suspension of $NiCO_3$. C. R. H.

Progress in analysis by emission spectra. R. INTONTI (Rend. 1st. San. Pubbl., 1938, **1**, 702—717). —A lecture. F. O. H.

Spectrographic analysis. R. F. RECODER (Anal. Asoc. Quím. Argentina, 1938, **26**, 171—202).—A lecture. F. R. G.

Spectrographic analysis of metals.—See B., 1939, 164.

Thallous carbonate as a standard in volumetric analysis. A. J. BERRY (Analyst, 1939, **64**, 27—28).—The prep. of pure Tl_2CO_3 from Tl is described. It may be used as a standard in both acidimetric and oxidative reactions. E. C. S.

Identification of chlorates. F. AMELINK (Pharm. Weekblad, 1939, **76**, 57—58).—1% solutions of ClO_3' give characteristic microcryst. ppts. with a 1% solution of methylene-blue. S. C.

Use of benzidine and o-tolidine in chemical analysis. L. M. KULBERG (Zavod. Lab., 1938, **7**, 905—913).—o-Tolidine is a more sensitive reagent for detection of a no. of cations and anions than is benzidine. R. T.

Photocolorimetric determination of fluorine. R. E. OSCHEROVITSCH (Zavod. Lab., 1938, **7**, 934—936).—A solution of 1 g. of apatite or phosphorite in H_2SO_4 is distilled into a receiver containing 1·5 g. of KCl, and H_2O is added to 500 ml. To 10—20 ml. of the solution (0·06—0·14 mg. F) are added 0·04 mg. Al (as $AlCl_3$), 5 ml. each of N-HCl, 3N-NH_4OAc, and 0·1% aluminon (NH_4 aurintricarboxylate), 0·5 ml. of 5N-$(NH_4)_2CO_3$, and H_2O to 100 ml., and the intensity of coloration is compared after 1 hr. with that given by standard solutions. R. T.

Determination of small amounts of oxygen in gases, with the aid of cuprous chloride. V. V. SHDANOV and D. E. ZILBERMAN (Zavod. Lab., 1938, **7**, 936—942).—Traces of O_2 in gases are determined by comparing the coloration developed after shaking in a special apparatus (described) 1 l. of gas with 25 ml. of a solution of CuCl in aq. NH_3 with that given by known amounts of O_2. R. T.

Colour reaction for sulphur. L. VAN ITALLIE (Pharm. Weekblad, 1937, **75**, 1445—1448).—The blue colour with C_5H_5N and NaOH (cf. A., 1938, I, 369) will detect 0·005 mg. of S. It is inhibited by CS_2, but not by C_6H_6 or $CHCl_3$, and is attributed to a blue form of S. Se and Te also give colorations with C_5H_5N and NaOH. S. C.

Determination of sulphur in nickel.—See B., 1939, 160.

Volumetric determination of sulphur in coal.—See B., 1939, 117.

Determination of sulphur in ointments and other medicinal forms.—See B., 1939, 212.

Detection of hydrogen sulphide in air.—See B., 1939, 220.

Determination of nitrogen in mixed fertilisers containing nitrates and chlorides.—See B., 1939, 188.

Photometric determination of phosphorus in steel.—See B., 1939, 158.

Determination of phosphate in apatites.—See B., 1939, 146.

Colorimetric determination of arsenic by the hypophosphite method. B. S. TZIVINA and B. M. DOBKINA (Zavod. Lab., 1938, **7**, 1116—1120).— 10 ml. of the solution of As, 2 ml. of 1% $CuSO_4$, and 5 ml. of saturated NaH_2PO_4, all in 1 : 1 HCl, are boiled for 2—3 min., and the coloration given is compared with that developed by standard As solutions. W and Sb do not interfere, but separation from Mo and Hg (described) is necessary. R. T.

Determination of quartz by differential thermal analysis. F. TROMBE (Compt. rend., 1938, **207**, 1111—1113).—A sensitive method by which quartz in a SiO_2 mixture can be identified and determined by differential thermal analysis is described. W. R. A.

Micro-analysis of silicates. A. K. BABKO (Zavod. Lab., 1938, **7**, 1121—1124).—Si is determined in 3—5 mg. of silicate by the C_5H_5N–silicomolybdate method. 10—15 mg. of silicate are treated with H_2SO_4–HF to remove SiO_2, the residue is dissolved in H_2O, and Mn, Ca, Mg, Al, Ti, and Fe are determined in the solution by known methods. 10 mg. of mineral are heated with H_2SO_4–HF, and K and Na are determined in the residue by known methods. R. T.

Volumetric determination of carbon monoxide. G. VENTUROLI (Boll. Chim. farm., 1939, **78**, 1—4).—The method is based on the oxidation of CO to CO_2 by $KMnO_4$; 1 c.c. of 0·1N-$KMnO_4 \equiv 1·4$ mg. or 1·12 c.c. of CO. F. O. H.

Automatic determination of alkalinity and hardness of condensates.—See B., 1939, 112.

Pontius' chlorometric method. M. CHAMBON (Bull. Soc. chim., 1939, [v], **6**, 240—244).—A correction (cf. A., 1939, I, 37). E. S. H.

Use of bromate in volumetric analysis. VII. Potentiometric titration of hydroxyquinoline. G. F. SMITH and R. L. MAY (J. Amer. Ceram. Soc., 1939, **22**, 31—33).—8-Hydroxyquinoline (and its Mg salt) was directly titrated at 50—60° in presence of HCl with a standard bromate solution, using a polarised Pt–Pt electrode system in conjunction with an electron beam sectrometer as indicator. The results agreed well with those by the standard gravimetric methods for Mg and the previous elimination of CaO was not necessary. The bromination reaction was greatly catalysed by traces of OsO_4 and by the chlorides of Mg, Cu, and Fe in larger quantities. J. A. S.

Quinaldinic acid as analytical reagent. III. Determination of zinc in presence of copper, silver, and mercury. P. RÂY and N. K. DUTT (Z. anal. Chem., 1939, **115**, 265—268; cf. A., 1935, 597).—For the determination of Zn in presence of Cu, the solution is neutralised and then acidified with dil. AcOH. The Cu is reduced by addition of aq. $NaHSO_3$, and the Cu˙ ion kept in solution by means of $CS(NH_2)_2$. The Zn is then pptd. and weighed as $Zn(C_{10}H_6O_2N)_2,H_2O$. For Zn in presence of Hg and Ag the addition of $NaHSO_3$ is omitted. For Zn in presence of Cu, Hg, and Ag, excess of KI is added to the neutral solution, followed by aq. $NaHSO_3$ and aq. $CS(NH_2)_2$ which dissolves the AgI. After acidification with AcOH the Zn is pptd. as above. Test data are recorded.   L. S. T.

Determination of zinc in babbitt metals.—See B., 1939, 159.

Quantitative spectrum analysis of solutions. IV. Determination of cadmium and zinc. A. K. RUSANOV and V. M. ALEXEEVA (Zavod. Lab., 1938, **7**, 963—967).—Cd and Zn are determined in solutions, by comparison of the intensity of the lines Cd 4799·91–Mn 4823·50 A., Zn 4722·16–Mn 4783·43 A., Zn 4810·53–Mn 4823·50 A. The error is $\pm 4·5\%$ for solutions containing 0·03—1% of Cd, and $\pm 2·7\%$ for solutions containing 0·01—1% of Zn.   R. T.

Rapid volumetric determination of cadmium in cyanide electrolytes.—See B., 1939, 165.

Application of internal electrolysis to determination of cadmium and magnesium in cadmium bronzes.—See B., 1939, 164.

New colour reagent for lead and its use as an indicator in the titration of various cations and anions (Pb, Zn, WO_3, MoO_3, V_2O_5, P_2O_5, As_2O_5). B. S. EVANS (Analyst, 1939, **64**, 2—14).—The reagent is prepared by mixing 30 ml. of C_5H_5N, 2 ml. of aq. HNO_3 (ρ 1·2), and 120 ml. of H_2O, adding 10 ml. of 1·5% aq. diphenylcarbazide, and keeping overnight. With $Pb(NO_3)_2$ a cherry-red colour or (in presence of $COMe_2$) that of MnO_4' is produced. Excess of acid or alkali must be avoided. Pb may be determined by developing the colour in presence of $COMe_2$ and titrating with aq. H_3PO_4 until the colour disappears. WO_3, MoO_3, V_2O_5, P_2O_5, and As_2O_5, which form insol. Pb salts, may be determined by titration with $Pb(NO_3)_2$ in presence of the reagent until a pink tinge develops. The conditions for each radical are specified. Zn, Co, and Ni give purple-red colours tending to ppt., Hg intense violet, and Fe^{II}, Cd^{II}, and V^V red.   E. C. S.

Rapid determination of lead in the atmosphere. G. C. HARROLD, S. F. MEEK, and F. R. HOLDEN (J. Ind. Hyg., 1938, **20**, 589).—When large amounts of Fe are present in samples to be analysed for Pb by the dithizone method, fading will occur unless a small amount of NH_2OH,HCl is added (cf. B., 1937, 397).   E. M. K.

Spectroscopic determination of lead in electrolytic solutions of zinc sulphate.—See B., 1939, 166.
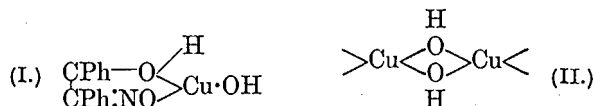
Thiocarbamide in quantitative analysis. III. Determination of thallium in presence of other

metals. C. MAHR and H. OHLE (Z. anal. Chem., 1939, **115**, 254—257; cf. A., 1938, I, 45).—Tl˙ or Tl˙˙˙ can be separated from Hg, Ag, Cu, Cd, Fe, Mn, Ni, Co, Cr, Al, Zn, Ba, Sr, and Ca in one pptn. by means of $CS(NH_2)_2$ in aq. $HClO_4$. When Pb is present a double pptn. is necessary, and when Pb and Ag are present NO_3' must be removed by evaporation with $HClO_4$. The solution containing 2% of $HClO_4$ is treated with an equal vol. of 10% aq. $CS(NH_2)_2$, and together with the pptd. $TlClO_4,4CS(NH_2)_2$ (I) is cooled in running H_2O for 30 min., filtered, and washed with 5% aq. $CS(NH_2)_2$ containing some $HClO_4$. The Tl is finally determined gravimetrically as $TlCrO_4$ after dissolution of (I) in aq. NH_3, or volumetrically with KI and $Na_2S_2O_3$ after treatment of (I) with excess of Br. In absence of Pb or Ag, the Tl can be determined as $TlNO_3,4CS(NH_2)_2$ by a method similar to that described for Pb (*loc. cit.*).   L. S. T.

Quinaldinic acid as a reagent for copper, zinc, and cadmium. R. J. SHENNAN (Analyst, 1939, **64**, 14—16).—Complete pptn. of Cu occurs at p_H 2·5—6·96, of Cd at p_H 3·9—7·2, and of Zn at p_H 2·3—6·5. The reagent is not suitable for the separation of these metals.   E. C. S.

Synthesis of groups specific for certain atoms in analytical chemistry. IV. Groups for the specific detection of copper. J. V. DUBSKÝ and A. LANGER (Chem. Obzor, 1938, **13**, 178—184).—Feigl's formula for the Cu^{II} salt of benzoinoxime ("Cupron") is questioned. It is a basic Cu^{II} salt (I), easily polymerised to a "diol" salt as in (II),

(I.) $\begin{matrix} CPh-O \\ CPh:NO \end{matrix}\!\!>\!\!Cu·OH$ $>\!Cu\!<\!\begin{matrix} O \\ O \end{matrix}\!>\!Cu\!<$ (II.)

which is insol. in AcOH, and absorbs traces of $Cu(OH)_2$ and NH_3 but does not form an additive complex with the latter.   F. R.

Determination of copper and manganese in fabrics.—See B., 1939, 131.

Assay of strong ointment of mercuric nitrate. —See B., 1939, 212.

Analysis of Mersalyl.—See B., 1939, 213.

Mercurimetric determination of medicinal products.—See B., 1939, 213.

Microchemical determination of manganese by oxidation with potassium persulphate. T. W. RAY (J. Lab. clin. Med., 1938, **23**, 1304—1310).—A crit. study was made to determine the conditions necessary for the complete oxidation of a Mn˙˙ salt to $HMnO_4$ in HNO_3 using $AgNO_3$ as a catalyst. The findings, showing the necessity of adjusting the acid to the particular amount of catalyst used, are recorded in graphic form, making it possible to determine optimal quantities by inspection.   C. J. C. B.

New method of attack in analysis of ferrous phosphide. O. QUADRAT and V. VČELÁK (Coll. Czech. Chem. Comm., 1938, **10**, 583—592).—Fe^{II} phosphide is oxidised by boiling H_2SO_4 to $Fe_2(SO_4)_3$ and H_3PO_4. After diluting with H_2O, filtering out

SiO_2, adding NH_3, and dissolving $Fe(OH)_3$ with HNO_3, P is determined by molybdate, the residue being calcined below 500° and weighed as $P_2O_5,24MoO_3$. The results are approx. 1% > those by the $Mg_2P_2O_7$ method. Evidence is given for the similarity in cryst. form (rhombic system) of anhyd. $Fe_2(SO_4)_3$ obtained by oxidation of $FeSO_4$ or Fe_3P_2 with boiling H_2SO_4, the insol. crystals from Fe_3P_2 containing adsorbed H_3PO_4.   F. H.

Iodometric determination of iron in Easton's syrup and Parrish's syrup.—See B., 1939, 213.

Potentiometric determination of molybdenum. N. K. SENIUTA (Zavod. Lab., 1938, 7, 1038—1039).— The solution of Mo^{VI} is made alkaline with Na_2CO_3, and then acid with AcOH. Excess of $0.1N$-$Pb(NO_3)_2$ is added to the boiled solution, which is then filtered, and the ppt. is washed. An equal vol. of EtOH is added to the filtrate + washings, and excess of $Pb(NO_3)_2$ is titrated potentiometrically at 75°, with $0.1N$-$K_4Fe(CN)_6$ [$HgCl_2$ and Pt–$Fe(CN)_6''''$–$Fe(CN)_6'''$ electrodes].   R. T.

Vanadometry—a new volumetric oxidation method. V. S. SIROKOMSKI and J. V. KLIMENKO (Zavod. Lab., 1938, 7, 1093—1100).—The solution of Mo^{VI} in $5N$-H_2SO_4 is shaken with Zn–Hg to reduce Mo^{VI} to Mo^{III}, which with Fe^{III} gives Mo^V and Fe^{II}. The solution is titrated with $0.1N$-$(NH_4)_3VO_4$ (phen-anthranilic acid indicator) ($Fe^{II} + V^V \rightarrow Fe^{III} + V^{IV}$; $Mo^V + V^V \rightarrow Mo^{VI} + V^{IV}$); the error, for amounts of 2—9 mg. Mo, is ≯ +0·04 mg. Mo is determined in presence of V by reducing Mo^{VI} to Mo^V with Hg in 2—3N-HCl, and titrating as above. PO_4''' is determined by pptn. as phosphomolybdate, which is dissolved in aq. NH_3, and Mo is reduced and titrated as above; this method is more accurate than is the ordinary alkalimetric one. Fe is determined in presence of V by reducing with $SnCl_2$ in HCl solution, removing excess of $SnCl_2$ with $HgCl_2$, and titrating Fe^{II} as above. Cu is determined by reduction with Bi–Hg to Cu^I, adding Fe alum, and titrating the Fe^{II} formed, as above.   R. T.

Determination and recovery of molybdenum in hard steels.—See B., 1939, 158.

Hydroxyquinoline method of determination of tungsten in steel.—See B., 1939, 158.

Volumetric determination of tin and antimony present together. G. A. PEVTZOV (Zavod. Lab., 1938, 7, 916—917).—10 drops of indigo-carmine are added to a solution of Sn^{II} and Sb^{III} in $8N$-HCl at 50—60°, and the solution is titrated in a CO_2 atm. with $0.1N$-$KBrO_3$–KBr, to a blue coloration (Sn^{II}), and then to decolorisation (Sb^{III}). Sb^V is determined by titration, as above, after adding a known excess of $SnCl_2$.   R. T.

Separation of tin and antimony : analysis of white metals.—See B., 1939, 160.

Determination of vanadium in steel.—See B., 1939, 158.

Sensitive micro-crystalline reactions of elementary bismuth and antimony. G. DENIGÈS (Compt. rend., 1938, 207, 1358—1360).—Bi is treated with a drop of EtOH–I; on evaporation characteristic

black crystals of BiI_3, affording orange $BiI_3,3NH_3$ with NH_3, are formed. Similarly Sb gives orange SbI_3 and white $SbI_3,3NH_3$. The technique of the tests is described.   A. J. E. W.

Determination of niobium and tantalum with the aid of phenylarsinic acid. I. P. ALIMARIN and B. I. FRID (Zavod. Lab., 1938, 7, 913—916).—The mixture, containing 0·1 g. each of Al_2O_3, Fe_2O_3, V_2O_5, U_3O_8, MnO_2, Ce_2O_3, La_2O_3, and 2—30 mg. of $Nb_2O_5 + Ta_2O_5$, is fused with $K_2S_2O_7$, the melt is dissolved in 150 ml. of N-HCl, and the solution is filtered. Excess of 3% $PhAsO_3H_2$ is added to the filtrate, which is boiled for 1 hr.; on the next day the ppt. of $[M_2O_4(PhAsO_3)_2]H_2$ (M = Ta, Nb) is collected, washed with 4% NH_4NO_3, ignited at 1000°, and weighed as M_2O_5. The ppt. may contain Ti; if this is present it should be determined colorimetrically, and the corresponding wt. of TiO_2 subtracted from that of M_2O_5.   R. T.

Quantitative separation of niobium and tantalum from titanium and zirconium, with the aid of pyrogallol. I. P. ALIMARIN and B. I. FRID (Zavod. Lab., 1938, 7, 1109—1116).—The mineral is fused with $K_2S_2O_7$ at 650—700°, the melt is boiled with 5% aq. pyrogallol, the solution is boiled with excess of aq. NH_3, HCl is added to approx. 1N., and the solution is boiled for 30—40 min. The ppt. is washed with 1% pyrogallol and ignited, and the entire process is repeated. The final residue of $Nb_2O_5 + Ta_2O_5$, which is still contaminated with SiO_2, Ti, and Fe, is heated with H_2SO_4–HF to eliminate Si, the residue is fused with $K_2S_2O_7$, the melt is dissolved in 10% tartaric acid (adding aq. NH_3, if the solution is turbid), and the solution is saturated with H_2S, and filtered. The filtrate + washings are boiled to eliminate H_2S, HCl is added to 1N., and the solution is boiled with 3% $PhAsO_3H_2$. The ppt. is collected, washed with 4% NH_4NO_3, ignited, and weighed as $Nb_2O_5 + Ta_2O_5$.   R. T.

Colorimetric determination of gold. I. N. PLAKSIN and N. A. SUVOROVSKAJA (Zavod. Lab., 1938, 7, 1202—1203).—The ordinary colorimetric reduction methods are applicable only to pure salts; salts of most of the heavy metals, and even alkali metal salts, interfere with development of the coloration. R. T.

Rapid determination of gold in cyanide plating solutions.—See B., 1939, 161.

Construction of laboratory electric furnaces and available materials. L. WALDEN (J. Sci. Instr., 1939, 16, 1—9).—The sp. uses and sources of supply of heating elements and refractory materials for laboratory electric furnaces are given.   D. F. R.

Oven with a temperature gradient, for the study of recrystallisation phenomena. V. A. ERACHTIN (Zavod. Lab., 1938, 7, 1060).—Apparatus is described.   R. T.

Thyratron thermoregulator. S. I. REMPEL (Zavod. Lab., 1938, 7, 1053—1056).—Apparatus is described.   R. T.

Sensitive temperature and pressure measurement. I. S. ZAMENHOF (Acta Phys. Polon., 1938,

7, 1—4).—By inserting a thin resistance wire into the capillary tube of a thermometer, so that the rising Hg thread short-circuits the wire and diminishes its resistance, temp. can be determined accurately from the resistance measured by a Wheatstone bridge. The theoretical sensitivity of this arrangement is decreased largely by friction between the Hg and the wire, and by other complicated phenomena. This method can be extended to accurate measurement of pressure by inserting a resistance wire into the tube of a Hg manometer. With constantan wire 0·05 mm. diameter in a tube of diameter 10 mm., Hg movements of 0·01 mm. have been measured. W. R. A.

Method for determining uniformity of temperature in cryostats. M. SHEPHERD (J. Res. Nat. Bur. Stand., 1938, 21, 831—834).—A sensitive differential v.p. manometer described is suitable for detecting temp. fluctuations at the surface of a liquid below room temp. J. A. K.

Hot-wire method for thermal conductivities of gases. G. G. SHERRATT and E. GRIFFITHS (Phil. Mag., 1939, [vii], 27, 68—75).—The method described employs a thick wire, the conduction at the ends being eliminated by auxiliary heating coils maintained at the same temp. as the wire. The thermal conductivity of CO_2, dry air, and CCl_2F_2 has been measured. The results are not in good agreement with Eucken's formula for the relation between conductivity, viscosity, and sp. heats. J. A. K.

Production of extremely low temperatures. S. ZAMENHOF (Acta Phys. Polon., 1938, 7, 125—126). —The proposed method employs expansion of He vapour in a Laval nozzle and should produce a temp. below 0·7° K. It has not yet been tested experimentally for the lowest temp. J. A. K.

High vacua for obtaining low temperatures. S. ZAMENHOF (Physica, 1939, 6, 47—48).—Adsorbents such as active C, SiO_2 gel, etc., at sufficiently low temp., can absorb vapours at rates > the max. rate of exhaustion attainable with diffusion pumps at pressures <5 μ. Hg. L. J. J.

True temperature scale of an oxide-coated filament. C. H. PRESCOTT, jun., and J. MORRISON (Rev. Sci. Instr., 1939, 10, 36—38).—The spectral emissive power of an oxide-coated filament has been obtained from measurements of the diffuse reflexion coeff. Results are recorded for a particular type of filament containing dispersed Ni. J. A. K.

Use of Kovar-glass seal in an X-ray cryostat. E. M. McNATT (Rev. Sci. Instr., 1939, 10, 42).— Apparatus described is convenient for holding a crystal in a vac. for measurements of the scattering of X-rays at the temp. of liquid air. J. A. K.

Rapid method of X-ray analysis. V. I. ARCHAROV (Zavod. Lab., 1938, 7, 1192; cf. A., 1939, I, 43).—Constructional improvements are described. R. T.

Imperfect crystals in X-ray spectroscopy. J. M. BAČKOVSKÝ (J. Phys. Radium, 1938, [vii], 9, 471—478).—The use of imperfect crystals with mosaic structure in X-ray spectroscopy has been studied. With a spectrograph with a symmetrical arrangement (crystal midway between slit and photographic plate) the widening of the lines due to the mosaic structure is very small and within the limit of experimental error. With an asymmetrical arrangement (crystal not midway), however, a notable widening of the lines is obtained from which the imperfection in the mosaic structure of the crystal can be evaluated. Thus, with the latter type of spectrograph, a perfect crystal must be used for measurement of X-rays. W. R. A.

Limit of the separating power of X-ray spectrographs using a method of focussing with a crystal of variable curvature. V. DOLEJSEK and M. TAYERLE (J. Phys. Radium, 1938, [vii], 9, 465—470).—An extension of previous work (A., 1938, I, 66, 100). W. R. A.

Bent-crystal transmission spectrograph for focussing hard radiation. H. JUPNIK (Rev. Sci. Instr., 1939, 10, 32—33).—Thin crystals are bent in a vice so that at. planes are radial, the radius of curvature being about 1 m. X-Rays from a point source incident on the convex side are brought to a focus on the circumference of a circle. A spectrograph constructed on this principle with 5 sheets of quartz 1 mm. thick is described. J. A. K.

Apparatus for luminescence analysis, for qualitative and quantitative purposes. A. SCHISCHLOVSKI (Zavod. Lab., 1938, 7, 1160—1171).— Apparatus is described. R. T.

Method for colour evaluation. P. F. SHUEY and L. K. DARBAKER (J. Amer. Pharm. Assoc., 1938, 27, 1216—1217).—The technique and apparatus necessary for the application of a null method to the photoelectric evaluation of colour are described; an accuracy > that by visual comparison is obtainable. F. O. H.

Christiansen dispersion filters for monochromators giving a bright and sharply defined beam. W. GEFFCKEN (Kolloid-Z., 1939, 86, 55—60).—A general account of the underlying principles and their application in modern practice. F. L. U.

Simplified electrode for potentiometric measurements. G. Z. NESSELSCHTRAUS (Zavod. Lab., 1938, 7, 1202).—A simple Pt–W electrode is described. R. T.

Photo-electric method of sedimentation analysis. A. S. EISUROVITSCH (Zavod. Lab., 1938, 7, 967—972).—Wagner's turbidimeter is convenient in use, and gives relatively accurate and reproducible results. R. T.

Appliance for measuring magnetic transformations, with the aid of a lamp generator K. N. POGODAEV (Zavod. Lab., 1938, 7, 972—976).— Apparatus is described. R. T.

Measurement of α and β activity with a cell with a barrier layer. P. BONET-MAURY (J. Phys. Radium, 1938, [vii], 9, 525—528).—An apparatus is described in which a cell with a barrier layer of Se is used for measurement of α and β activity. W. R. A.

Application of artificially-produced radioactivity. E. FERMI (Rend. Ist. San. Pubbl., 1938,

1, 421—432).—A large-scale apparatus for the production of radioactive substances by bombardment with neutrons is described and the application of radioactive substances in chemistry and biology discussed.   F. O. H.

Recording ionisation chamber. Direct-current amplifier system for artificial radioactive decay studies. S. W. BARNES (Rev. Sci. Instr., 1939, **10**, 1—5).—Apparatus described is designed to record ionisation currents for periods up to 30 hr. without attention, and is specially suited for weak radioactive sources of long period. A synchronous motor device brings the radioactive substance to the ionisation chamber window at fixed intervals and galvanometer deflexions are recorded photographically.   J. A. K.

Counter tube amplifier with optional amplification factor. P. WEISS (Physikal. Z., 1939, **40**, 34—37).—A simple amplifier with any given amplification factor from 1 to 40 and with a resolving power of $1·5 \times 10^{-3}$ sec. is described. A circuit suitable for investigating radioactive disintegrations is also described.   A. J. M.

Counter tube amplifiers. P. WEISS (Physikal. Z., 1939, **40**, 37—39).—A circuit for producing impulse pairs is described.   A. J. M.

Complete Geiger–Müller counting system. H. LIFSCHUTZ (Rev. Sci. Instr., 1939, **10**, 21—26).—Constructional details of a complete counting system are given, and its performance is discussed. Counting losses are negligible up to 30,000 counts per min.   J. A. K.

Experimental study of the sensitivity of a Geiger–Müller counter to a narrow beam of γ-rays. D. L. JORGENSEN (Rev. Sci. Instr., 1939, **10**, 34—36).—The sensitivity at different positions in a counter tube has been investigated. An increase of sensitivity near the ends of the cylinder is due to increased field strength.   J. A. K.

Portable Geiger counter unit. L. F. CURTISS (J. Res. Nat. Bur. Stand., 1938, **21**, 779—782).—With the portable apparatus described 1 μg. Ra can be measured at 1 m. or 1 mg. at 30 m.   J. A. K.

Grid potential in the Neher–Pickering circuit. A. W. COVEN (Rev. Sci. Instr., 1939, **10**, 43).—Negative grid potential from a dry cell shunted with a variable resistance allows adjustment of the circuit for most effective control of the counter.   J. A. K.

New sensitive light-counter. R. TZSCHASCHEL (Z. Physik, 1938, **111**, 215—231).—A sensitive counter for photo-electrons is described. It operates on the principle of amplification of the accelerated primary electrons by collision ionisation followed by counting in the usual way. The accuracy is exemplified by typical measurements.   L. G. G.

Method of working of a proton tube. T. FRANZINI (Atti R. Accad. Lincei, 1938, [vi], **27**, 292—297).—An apparatus for the production of a current of protons from a heated hydrogenated Pd tube is described.   O. J. W.

Magnetic method of separating electrified particles in an inhomogeneous field (trochoidal orbits). J. THIBAUD (Nuovo Cim., 1938, **15**, 313—342; cf. A., 1934, 825).—A more detailed account of the author's method of concentrating and focussing weak beams of electrically charged particles using trochoidal orbits, and of its applications in at. physics.   O. J. W.

Electron microscope. L. C. MARTIN (Nature, 1938, **142**, 1062—1065).   L. S. T.

Determination of the size of crystallites in metal and metallic oxide smokes with X-ray and electron diffraction diagrams and with electron microscope photographs. (A) F. KRAUSE. (B) D. BEISCHER (Z. Elektrochem., 1939, **45**, 117; cf. A., 1938, I, 397).—(A) The electron microscope with a better resolution than that of an optical microscope was used by Krause for the examination of the structure of etched Ag foil prior to his collaboration with Beischer.

(B) Data obtained by the observation of well-defined colloidal preps. (*loc. cit.*) yielded information concerning the limit of resolution of the electron microscope and the directions in which it can be further improved.   J. W. S.

Continuous-action laboratory steam generator. J. B. ASCHKINAZI (Zavod. Lab., 1938, **7**, 1200).—Apparatus is described.   R. T.

Indicator of the level of liquids, with mechanical amplification. N. I. ARCHIPOV (Zavod. Lab., 1938, **7**, 1061—1062).—Apparatus is described.   R. T.

Laboratory apparatus for conducting reactions under pressure. B. I. KISSIN, G. I. LUKANIN, and V. A. MIKELMAN (Zavod. Lab., 1938, **7**, 1059).—Apparatus is described.   R. T.

Instrument for measurement of anomalous viscosity. C. F. GOODEVE (J. Sci. Instr., 1939, **16**, 19—27).—The fluid is contained between two conical surfaces, one rotating and the other suspended from a torsion head. By using cones instead of cylinders, very high rates of shear may be obtained without turbulent flow by decreasing the distance of separation of the two conical surfaces. The viscosimeter is especially designed for the measurement of anomalous viscosities encountered in thixotropic fluids.   D. F. R.

Viscosity of materials with flow-solidity. V. Z. DANEŠ (Coll. Czech. Chem. Comm., 1938, **10**, 593—610).—An apparatus for measuring η of anomalous liquids over a wide range of shear strain is described. η of a benzopurpurin sol compared with η of a normal liquid, for various shear strains in capillaries of varied diameters and lengths, decreases with increase in length of capillary owing to destruction of the particles caused by flow in the capillary. In sufficiently narrow and long capillaries pseudo-laminary stationary flow is possible since destruction occurs mainly at the inlet and reaches a limit beyond which further increase in mechanical strain does not change the particle size. The dependence of η on the diameter of the capillary cannot be explained in terms of shear strain.   F. H.

Micropyknometer for the determination of densities of heavy solids. H. WINCHELL (Amer.

Min., 1938, **23**, 805—810).—A const.-vol. (~0·1 c.c.) quartz-glass pyknometer is described. PhMe is used as the displacement liquid. Air bubbles are better removed by boiling under reduced pressure than by centrifuging. An ordinary balance, accurate to 0·1 mg., can be used. With 0·03—0·04 c.c. of material of ρ 4—7·5, results are accurate to ~1%. Test data for pyrite, sphalerite, and galena are given.
                                                    L. S. T.

Inductional tensimeter. G. E. RUDASCHEVSKI (Zavod. Lab., 1938, **7**, 990—995).—Apparatus is described.   R. T.

Tensiometer with a flexible (metallic) sheet for measurement of surface tensions. H. LEMONDE (J. Phys. Radium, 1938, [vii], **9**, 505—511).—In a new tensiometer, which is described, the amount of bending of a flexible metal sheet, caused by the pull of the liquid on a rectangular wire frame suspended from the sheet, is used to evaluate γ of the liquid. The bending is measured to within 0·01 mm. by fixing a micrometer objective on the sheet and viewing it through a microscope.   W. R. A.

Apparatus for automatic cleaning of laboratory vessels. P. HERRMANN (Chem.-Ztg., 1939, **63**, 24).—The principle of the Soxhlet extraction is employed, using CCl_4 or other suitable solvent.
                                                    E. S. H.

Siphon head for Dewar flasks. G. C. ELTENTON (J. Sci. Instr., 1939, **16**, 28).—A small electric heater in the closed Dewar vessel causes liquid to be forced through the siphon into a subsidiary vessel; the latter contains a float which operates the relay-controlled heater. The level in the Dewar vessel may be maintained to within ±0·5 mm. over a period of hours.   D. F. R.

Simple and variable greaseless leak. G. C. ELTENTON (J. Sci. Instr., 1939, **16**, 27—28).—A length of W wire is threaded through a glass capillary. Half of the wire, originally a close fit in the tube, is thinned by dissolving uniformly in molten $NaNO_2$ and $NaNO_3$ (1 : 1). The wire is attached at each end to glass-encased Fe cores and the variation in the leak effected by moving the wire electromagnetically.   D. F. R.

Simple arrangement for the preparation of carbon dioxide free from air. H. REIHLEN (Ber., 1939, **72**, [B], 112—114).—The apparatus is designed to deliver a supply of pure CO_2 whenever required, without contamination by air even after long periods of disuse.   F. J. G.

Permanent covering for the necks of hot-water wash bottles. LABORATORY STAFF, DARTINGTON HALL (Chem. and Ind., 1939, 50).—An insulating grip around the neck of a flask can be made by allowing a $\frac{3}{16}$-in. layer of wet filter-paper pulp to dry completely, and then applying several coats of cellulose varnish.   O. M.

Simple rapid dialyser. K. HAGENGUTH (Chem.-Ztg., 1939, **63**, 80).—An apparatus for use with Cellophane membranes is described.   S. M.

Simple protective device for vacuum systems. M. C. HENDERSON (Rev. Sci. Instr., 1939, **10**, 43).—Failure of the vac. is detected by a 25-w. electric light bulb used as a Pirani gauge, and the contacts of a relay are automatically opened by a simple valve circuit. The device is suitable for systems where Hg is prohibited. It was designed to protect the filaments of the 50-kw. valves of a cyclotron.   J. A. K.

Sensitive differential manometer. W. HURST (Rev. Sci. Instr., 1939, **10**, 27—29).—The movement of a small rubber diaphragm is magnified by a train of gears from a small jewelled wrist-watch movement. Pressure variations may be as small as 0·0012 cm. Hg and as rapid as 15 per sec.   J. A. K.

Behaviour of filter materials towards concentrated alkalis. R. SCHOLDER and G. HENDRICH (Chem. Fabr., 1938, **11**, 541—543, and Kolloid-Z., 1939, **86**, 16).—Jena glass fritted filters show satisfactory resistance to 50—60% NaOH at 90°, although the pore size is slowly increased with continued use. At temp. >115° the glass is rapidly destroyed. Filters of SiC offer no advantages over glass and are less resistant.   F. L. U.

Capacity of fritted filters to withstand chemical attack in analytical work with alkaline liquids. H. BRINTZINGER and B. ROST (Chem. Fabr., 1938, **11**, 543—545, and Kolloid-Z., 1939, **86**, 16—17).—Filter crucibles of Jena glass or Berlin porcelain are satisfactory for quant. work with liquids of alkalinity up to 2N-NaOH, provided they are previously washed with liquid similar to that which is to be filtered. Any detectable loss of wt. (max. 1 mg. with 500 c.c. of 2N-NaOH) occurs only during the first washing. Filter plates of SiC are more readily attacked than glass or porcelain, and the attack is repeated in subsequent filtrations.   F. L. U.

Apparatus for automatic filtration, washing, and extraction. G. KAPSENBERG (Kolloid-Z., 1939, **86**, 18—30).—Various arrangements are described and discussed (cf. A., 1937, I, 380).   F. L. U.

Percolators and perforators. H. DIETERLE (Kolloid-Z., 1939, **86**, 31—32).—Liquid extraction apparatus (perforators) and the use of a percolator for adsorption filtration are described. F. L. U.

Possible analytical applications of apparatus for technical determination of sulphur and halogens described by Grote and Krekeler and in D.R.P. 642,166. B. WURZSCHMITT (Kolloid-Z., 1939, **86**, 33).   F. L. U.

Glass tubing systems. F. SIEPER (Kolloid-Z., 1939, **86**, 60—62).—New types of joints are described.
                                                    F. L. U.

Supersonic velocity in gases and vapours. IV. Measurement of the absolute frequency of piezoelectric quartz oscillators. S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 1—17).—The double step-down unsymmetrical multivibrator described gives low frequencies which are measured by means of a phonic wheel or synchro-clock, checked against a standard clock. For frequencies >150 khz. a beat method can be used.   L. J. J.

Accurate determinations of mol. wts. by the principle of gas displacement. U. VON WEBER (Angew. Chem., 1939, **52**, 34—35).—Results accurate to ±0·3% are obtained from an improved Victor Meyer v.d. apparatus.   K. W. P.

Micro-mol. wt. determination by Rast's method. H. Böhme and E. Schneider (Angew. Chem., 1939, **52**, 58—60).—A review.   A. Li.

Blaise de Vigenère, John Ferguson, and benzoic acid. T. S. Patterson (Ann. Sci., 1939, **4**, 61—64).

August Kekulé and the benzene problem. O. J. Walker (Ann. Sci., 1939, **4**, 34—46).

Amos Eaton as a chemist. H. S. Van Klooster (Rensselaer Polyt. Inst., 1938, Bull. 56, 20 pp.).

Crystal gazers and alchemists. P. Walden (Chem.-Ztg., 1939, **63**, 92—93).

Geochemistry.

Daily variations of the mean temperature of atmospheric ozone. (Mme.) A. Vassy and E. Vassy (Compt. rend., 1938, **207**, 1232—1234).—Wide daily variations in the effective thickness and mean temp. of atm. O_3 have been detected by spectrographic observations (in Morocco). The changes are correlated with movements of air in the stratosphere.   A. J. E. W.

Stratification of the ionosphere. J. N. Bhar (Indian J. Physics, 1938, **12**, 363—386).—A calculation of atm. ionisation has been made assuming the upper atm. above 100 km. to be mainly N_2 and O and below to be N_2 and O_2, and assuming approx. vals. for temp. distribution, absorption coeff., etc. Ionisation max. are found at 250 km. due to O, 160 km. due to N_2, and 90 km. due to O_2; these are identified with the so-called F_2, F_1, and E_1 regions.   J. A. K.

Quantity of zinc contained in sea-water. G. Bertrand (Compt. rend., 1938, **207**, 1137—1141).—Determinations by a modified $CaZnO_2$ method, which is described, show the occurrence of $3\cdot1$—$3\cdot8$ mg. of Zn per l. in French sea-waters containing $32\cdot4$—$38\cdot8$ g. per l. of total solids. The Dead Sea contains $4\cdot37$ mg. of Zn per l., with a total solid content of 236 g. per l.; the lack of proportionality suggests that the origin of the Dead Sea is different from that of the Mediterranean.   A. J. E. W.

Plankton and properties of the surface waters of the Puget Sound region. T. G. Thompson and L. D. Phifer (Univ. Wash. Publ. Oceanography, 1936, **1**, 111—134).—Data are recorded.   Ch. Abs. (e)

Distribution of phosphates in the sea-water of the N.E. Pacific. I. Igelsrud, R. J. Robinson, and T. G. Thompson (Univ. Wash. Publ. Oceanography, 1936, **3**, 1—34).—Data are recorded and discussed.   Ch. Abs. (e)

Formation of Widmanstätten figures in meteorites. E. A. Owen (Nature, 1938, **142**, 999—1000).—Conclusions reached from an investigation of the system Fe–Ni and of the structure of Fe–Ni meteorites are summarised.   L. S. T.

Formation of Widmanstätten figures in meteorites. S. W. J. Smith and J. Young (Nature, 1938, **142**, 1162).—Owen's conclusions (preceding abstract) are criticised. The heating produced by passage through the atm. is insufficient to affect the structure of the meteorite at a depth $>0\cdot5$ in., and the Widmanstätten structure must have been present in the meteorite before it passed through the atm.   L. S. T.

N'Goureyma meteoric iron. R. Bedford (Nature, 1938, **142**, 1161—1162).—A transverse section of this Fe shows only a narrow alteration zone at the surface and affords no evidence that the internal structure is due to softening or melting in its passage through the atm. Two possible explanations of the structure of this meteorite are discussed.   L. S. T.

Evaluation of the earth's temperature arising from radioactivity. A. N. Lowan and F. King (Physical Rev., 1938, [ii], **54**, 1109—1110).—Mathematical.   N. M. B.

Application of p_H to speleology. M. Déribéré (Ann. Chim. Analyt., 1939, [iii], **21**, 5—7; cf. A., 1936, 1482).—The significance of the p_H vals. of various argillaceous sedimentary beds with respect to their formation is discussed.   E. H. S.

Application of the helium method to granites. N. B. Keevil (Trans. Roy. Soc. Canada, 1938, [iii], **32**, IV, 123—150).—Rock powders appear to lose none of their He on keeping in air, and the He does not tend to diffuse to a uniform concn. throughout the rock, but remains closely associated with its parent minerals (cf. also, A., 1939, I, 106). Certain minerals such as felspar seem to have lost some He during their geologic life. Methods for the determination of He, thoron, and Rn, after fusion of the rock with Na_2CO_3, are described. Data on the trustworthiness of the He method recorded for various rocks show that within fairly wide limits there is no marked effect of grain-size, texture, or composition. Pegmatites may yield anomalous results, and granites yield, on the whole, a lower He index of age than basalts. The same age can be obtained for samples taken from an igneous mass at depths between 2 and 600 ft. from a fresh glaciated surface. The three methods of determining the He age agree and compare favourably with the geological succession found from field evidence. The activity found from separate Rn and thoron measurements agrees with the direct α-particle count by the method of Evans and Goodman (A., 1938, I, 584). The He ages of granites and basic rocks from various localities are tabulated. As at present developed the He method can distinguish between the ages of fresh similar type igneous rocks to within 10 or 20%.   L. S. T.

Katanga atacamite. J. Thoreau and J. Verhulst (Bull. Acad. roy. Belg., 1938, [v], **24**, 716—720). —Atacamite associated with gerhardtite as an inclusion in cuprite from the Likasi mine has a_0 6·01, b_0 9·13, and c_0 6·84 A. The unit cell contains $2[CuCl_2,3Cu(OH)_2]$. Laue data are given. L. S. T.

Geochemical interpretation of the quaternary formations of Grotta Romanelli (Terra d'Otranto). I. Data and methods of investigation. II. Colloidal complexes. G. A. BLANC [with T. MANTOVANI] (Atti R. Accad. Lincei, 1938, [vi], 27, 189—197; 28, 75—84).—I. The origin of these formations is discussed and methods of separating the detritic and colloidal complexes are described.

II. Chemical analyses are recorded of the inorg. colloidal complexes separated from the material found at different levels in the deposit in the grotto.
O. J. W.

Correlation of some acid members with the auriferous quartz veins in association with Dharwar formations in the western portion of the Raichur Doab. S. K. MUKHERJEE (J. Hyderabad Geol. Survey, 1938, 3, 50—88).—The characteristics and Au content of the quartz veins of the Dharwar belt and the origin of the Au are discussed.
L. S. T.

Marble deposits near Yellandu in Warangal district. S. KAZIM and C. MAHADEVAN (J. Hyderabad Geol. Survey, 1938, 3, 114—122).—Deposits of white, grey, and yellow marble occurring 4 miles N. of Yellandu are described, and their economic possibilities discussed. Chemical analyses are recorded.
L. S. T.

Cæsium and lithium in the Ilmen range in the Urals. A. F. SOSEDKO (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 311—313).—A mineral, reported from the pegmatites of the Ilmen range, contains a high concn. of Cs and Rb and a quantity of rare alkalis > that in amazonite.
O. D. S.

Mineralogy of three sulphate deposits [Chuquicamata, Quetena, and Alcaparrosa] of northern Chile. M. C. BANDY (Amer. Min., 1938, 23, 669—760).—The sulphate and chloride minerals are described, and their paragenesis and the geochemistry of their formation discussed. The oxidation of pyrite is the fundamental reaction in the formation of the sulphates found in these deposits. Seventy-six minerals, including bandylite, antofagastite, leightonite, ungemachite, lindgrenite, *metasideronatrite* (I), *parabutlerite* (II), szomolnokite (III), pickeringite (IV), rhomboclase (V), botryogen (VI), lapparentite (VII), and natrojarosite (VIII), are described. (I) from Chuquicamata is orthorhombic with $a : b : c = 0.4571 : 1 : 0.1187$, ρ 2.46, hardness 2.5, n_a 1.543, n_β 575, n_γ 1.634, and a chemical analysis [E. P. HENDERSON] corresponding with the formula $Na_4Fe_2(SO_4)_4(OH)_2,3H_2O$. (II) from Alcaparrosa is orthorhombic with $a : b : c = 0.7310 : 1 : 0.7218$, ρ 2.55, hardness 2.5, n_a 1.598, n_β 1.663, n_γ 1.737, and a chemical analysis [E. P. HENDERSON] corresponding with the formula $Fe(SO_4)(OH),2H_2O$. New crystallographic data for (III), (IV), (V), (VI), (VII), and (VIII) are recorded. (IV) from Quetena has $a : b : c = 0.8655 : 1 : 0.2551$, β 96° 33·5′, a_0 20·8, b_0 24·2, c_0 6·17 A., β 95°+, $a_0 : b_0 : c_0$ 0·860 : 1 : 0·255, with $Mg_4Al_8(SO_4)_{16},88H_2O$ per unit cell, space-group $P2/m$, ρ 1·73, hardness 1·5, n_a 1·475, n_β 1·480, n_γ 1·483. A chemical analysis [F. A. GONYER] is given. Halotrichite from Chuquicamata, monoclinic, has a_0 20·47, b_0 24·24, c_0 6·167 A., β 100·6°±1°, with $Fe_4Al_8(SO_4)_{16},88H_2O$ per unit cell, ρ 1·895, hardness 1·5, n_a 1·480, n_β 1·486, n_γ 1·490. A chemical analysis [F. A. GONYER] is recorded. Chemical analyses of ferrinatrites and leucoglaucite, of metavoltine and related minerals, of copiapite, and of botryogen are compared.
L. S. T.

Minerals associated with hilgardite [in the Choctaw salt dome]. C. S. HURLBUT, jun., and R. E. TAYLOR (Amer. Min., 1938, 23, 898—902; cf. A., 1938, I, 50).—The minerals in the insol. residue from this dome, viz., anhydrite, dolomite, magnesite in well-developed crystals, boracite, danburite, etc., are described.
L. S. T.

Petrological studies in the Harlech Grit series of Merionethshire. III. Development of pyrite in the grits and mudstones. A. W. WOODLAND (Geol. Mag., 1938, 75, 529—539; cf. A., 1939, I, 109). —In the grits pyrite (I) occurs associated with rocks of practically all grades, and in the mudstones it is conc. into layers. The zones of authigenous minerals which surround (I) crystals are described. The crystallisation of the (I) is discussed. Since this is always accompanied in these rocks by the separation of magnetite, a reaction of the type $6FeS + 2O_2 = 3FeS_2 + Fe_3O_4$ is probable.
L. S. T.

Structures of kaolin and talc-pyrophyllite hydrates, and their bearing on water sorption of the clays. S. B. HENDRICKS and M. E. JEFFERSON (Amer. Min., 1938, 23, 863—875).—Vermicuhtes, montmorillonite, and hydrated halloysite contain layers of H_2O mols. joined into extended hexagonal nets. The stability of the layer arises from the attraction between H atoms of the H_2O mols. and neighbouring O ions of the silicate layers, or O atoms of other H_2O mols. in the net. Diagrams illustrating the combination of H_2O and vermiculite (I) layers by binding through H, combined H_2O layers in partly-dehydrated (I), the probable structure of multiple H_2O layers on the surfaces of clays, the probable type of linking between OH groups in the $[(OH)_4Al_2Si_2O_5]_n$ layers of the kaolin minerals, and the structure of hydrated halloysite are reproduced and discussed. The H_2O-sorptive properties of clays are considered as arising from the formation of successive layers of the above type over the surfaces.
L. S. T.

Crystal structure of vermiculites and mixed vermiculite–chlorites. S. B. HENDRICKS and M. E. JEFFERSON (Amer. Min., 1938, 23, 851—862).—A Weissenberg study gives a_0 5·33, b_0 9·18, c_0 28·85 A., β 93° 15′ for vermiculites. A Fourier analysis of the reflexions leading to the electron distribution normal to (001) verifies the structure advanced previously by Gruner (A., 1935, 841) in that it requires interleaving of layers containing H_2O mols. with silicate layers similar to those of talc. Many minerals described previously as vermiculites are mixed vermiculite–chlorites similar to the mixed vermiculite–micas described by Gruner.
L. S. T.

Thaumasite from the Ducktown district, Tennessee. W. T. SCHALLER (Amer. Min., 1938, 23, 876—880).—An unusual form of thaumasite occurring as small tuffs of radiating crystals is described.
L. S. T.

Tarbuttite. W. E. RICHMOND (Amer. Min., 1938, 23, 881—893).—X-Ray and morphological data for tarbuttite (I) from Broken Hill, N. W. Rhodesia, are recorded. (I) has $a : b : c = 0.6296 : 1 : 0.5971$, α 89° 37½′, β 91° 28½′, γ 107° 41′, n_X 1·660, n_Y 1·705, n_Z 1·713 (all ± 0.003). Weissenberg photographs give a_0 8·097, b_0 12·91, c_0 7·688 A., α 89° 34½′, β 91° 35½′, γ 107° 47′. The vol. of unit cell is 765 A.³, and mol. wt. 1924. The unit cell is $16ZnO,4P_2O_5,4H_2O$ or $8[Zn_2PO_4(OH)]$.   L. S. T.

Hydrothermal alteration in the rocks of Pigeon Point, Minnesota. E. S. BASTIN (J. Gool., 1938, 46, 1058—1072).—The diabases, the granites, and the sediments of the Rove formation are described, and the metamorphic alterations that have occurred in them are discussed.   L. S. T.

Cadmium in smithsonite from New Mexico. W. T. SCHALLER and J. G. FAIRCHILD (Amer. Min., 1938, 23, 894—897).—Smithsonite from the Kelly Mine, Socorro Co., New Mexico, contains from 0·40 to 0·56% Cd, which can be present as CdS or $CdCO_3$, in its various layers. Cd may be present in smithsonite more often than is commonly supposed.   L. S. T.

Igneous rocks from the Abercorn and Kasama districts, N. Rhodesia. T. DEANS (Geol. Mag., 1938, 75, 547—558).   L. S. T.

Leucite rocks of the active volcano Batoe Tara (Malay archipelago). H. A. BROUWER (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 23—29).—The rocks of the volcano can be classified : (i) leucite-basanite lavas, (ii) leucite-basanite dykes, and (iii) young biotite-leucite-tephrites. Their constituents, microscopic structure, and chemical analyses are given.   W. R. A.

Felspars from pegmatites of Kodarma, Bihar. N. L. SHARMA (Proc. Indian Acad. Sci., 1938, 8, B, 266—279).—Two phases in the formation of felspars represented by orthoclase and microcline perthites and by albite–oligoclase respectively are explained by the differentiation of granitic residues into K- and Na-rich fractions.   A. G. P.

Two minettes from Val Nambrone (Adamello group). M. FENOGLIO (Atti R. Accad. Lincei, 1938, [vi], 28, 100—106).—Chemical analyses and petrographic data of two minettes from this region are recorded.   O. J. W.

Nature and composition of the organic matter of North African phosphates. Gafsa phosphate. V. VINCENT and P. BOISCHOT (Compt. rend., 1938, 207, 1248—1249).—Gafsa phosphates treated with dil. HCl liberate org. material, which gives a colour reaction for cellulose, and reacts with alkalis to the same degree as humus. Its N content (2·89%) resembles that of turf and acid soils, but it contains more Et_2O-sol. material, acids, and org. P. It contains no cellular elements but the org. coating of the PO_4''' granules is probably mainly of vegetable origin.   J. L. D.

Cannizzarite and bismuthinite from Vulcano, Lipari Islands. C. W. WOLFE (Amer. Min., 1938, 23, 790—798).—Cannizzarite (I), ρ 4·8, hardness 2—3, has a_0 11·73, b_0 14·47, c_0 4·076 A., $a_0 : b_0 : c_0 = 0.8106 : 1 : 0.2817$, (goniometer) $a : b : c = 0.8050 : 1 : 0.2828$; space-group D_{2h}^{10}—$Pnam$. A new chemical analysis [F. A. GONYER] gives the formula $Pb_3Bi_5S_{11}$. Bismutoplagionite and (I) appear to be identical. Bismuthinite from Vulcano has $a : b : c = 0.9862 : 1 : 0.3498$, ρ 6·46 (calc. 6·81), and Bi 80·29, Fe 0·38, Pb, Sb, As, each 0·00, S 19·48, total 100·15% [analyst, F. A. GONYER].   L. S. T.

Crystallography of lanarkite. W. E. RICHMOND and C. W. WOLFE (Amer. Min., 1938, 23, 799—804).—Lanarkite, Pb_2SO_5, from the Susanna Mine, Scotland, has (X-rays) a_0 13·73, b_0 5·68, c_0 7·07 A., β 116° 13′; space-group C_{2h}^3 — $C2/m$, n_X 1·928, n_Y 2·007, n_Z 2·036 (all ± 0.003). Morphological data are recorded and discussed. ρ is 6·92, and with the cell vol. 494·4 gives a unit cell $Pb_8S_4O_{20}$.   L. S. T.

Paragenesis of the Center Strafford, New Hampshire, pegmatite. G. SWITZER (Amer. Min., 1938, 23, 811—820).—This pegmatite has intruded gneissic rock and the main body, composed of microcline and quartz, has formed by crystallisation of a rest-magma. The complex constituents have been introduced by an extensive replacement process. Beryl, triphylite, graftonite, manganapatite, and albite were the first of these, and were introduced apparently by vapours or solutions rich in volatile constituents. After these, rhodochrosite, muscovite, garnet, loellingite, etc. were deposited by true hydrothermal solutions. Later, the earlier-formed phosphates were altered to vivianite, eosphorite, heterosite, etc. These minerals are described and chemical analyses [F. A. GONYER] of triphylite and loellingite are given.   L. S. T.

Pollucite [and petalite]. W. E. RICHMOND and F. A. GONYER (Amer. Min., 1938, 23, 783—789).—Replacements of petalite (I) by pollucite (II) and quartz at Greenwood, Maine, are described. (I) from this locality has n_{Na} 1·507, ρ 2·68, and a_0 (X-rays) 13·64. Data showing the decrease in n with a decrease in Cs content are given for (II) from other localities. Two new chemical analyses for (II) are given, and comparison with other analyses establishes the generalised formula $Cs_{14+x}Al_{14}(Al_xSi)_{34}O_{96},4$—$9H_2O$, where x is 1, 2, or 3. The amount of H_2O is inversely $\propto$ the Cs_2O content. (I) from Greenwood is exceptionally pure, and the new analysis agrees with the formula $LiAlS_4O_{10}$. (II) from Leominster, Massachusetts, has n_{Na} 1·520, ρ 2·89. A chemical analysis is given.   L. S. T.

Basic problems of origin of petroleum. K. KREJCI-GRAF (IIme Congr. Mond. Pétrole, 1937, 1, 361—365).—A crit. review.   R. B. C.

Physical chemistry and the origin of petroleum. G. R. SCHULTZE (IIme Congr. Mond. Pétrole, 1937, 1, 367—370).—A review.   R. B. C.

Petroleum cannot be generated in limestones. H. VON HETTINGA TROMP (IIme Congr. Mond. Pétrole, 1937, 1, 371—381).—A crit. review.   R. B. C.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

Wave-length measurements of deuterium and hydrogen Balmer lines. I. V. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 431—433).—Measurements of the first 10 lines of the Balmer series of D and H are recorded. The vals. of Rydberg's const. differ slightly from those previously obtained from measurements of the fine structure of H_a and D_a lines. J. A. K.

Influence of noble gases on the intensity of lines of hydrogen and deuterium Balmer series. II. V. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 435—436; cf. A., 1938, I, 432).—Addition of He to a discharge in H_2 and D_2 caused an increase in the relative intensity of the D lines, whilst H_2O, Ne, and A were practically without influence. J. A. K.

Continuous spectra of H_2 and D_2. H. M. JAMES and A. S. COOLIDGE (Physical Rev., 1939, [ii], **55**, 184—190).—Mathematical. A complete theoretical calculation is given and the accuracy of the Franck–Condon approximation is examined. N. M. B.

Fine structure of the line λ 4686 of ionised helium. D. Y. CHU (Physical Rev., 1939, [ii], **55**, 175—180).—The fine structure of λ 4686 of ionised He emitted from a hollow-cathode discharge tube cooled by liquid air was measured with a Fabry–Perot interferometer and the formula for the pattern obtained, expressed in Fourier series, was applied in the analysis. Of the 8 components predicted by theory, 4 were observed, and the remaining weak ones were inferred from the pattern to be present. Relative intensities and positions of the 8 components agreed with theory. The separation of the two strongest components was 0.4529 ± 0.0109 cm.$^{-1}$, and the calc. Rydberg const. for He was $109,722.430 \pm 0.030$. N. M. B.

Influence of the fine structure on the Stark effect of ionised helium. H. KUBOTA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 9—14).—A comparison between observed and calc. vals. D. F. R.

Concentration of the ^{15}N isotope and some spectroscopic investigations on ^{15}N. H. KRÜGER (Z. Physik, 1939, **111**, 467—474).—An elaboration of the preliminary note (A., 1938, I, 426). H. C. G.

Dellinger phenomenon. J. KAPLAN (Physical Rev., 1939, [ii], **55**, 110).—By varying the magnitude of the current in the exciting discharge in the high-pressure N_2 afterglow it is found that the three "connected" features, the Goldstein-Kaplan bands, the N_2^+ auroral bands, and the new λ 3246 bands, decrease together as the current increases, indicating that the two first-named systems may be produced by re-combination of N_2^+ ions. The phenomenon is analogous to that postulated in the ionosphere by Dellinger (cf. J. Appl. Physics, 1937, **8**, 732), and the associated radiation should throw light on the mechanism involved. N. M. B.

Second Townsend coefficient. J. KAPLAN (Physical Rev., 1939, [ii], **55**, 111).—A discussion of the energy of the metastable state of N_2 and the ionisation potentials of N_2 and Hg with reference to Bowls (cf. A., 1938, I, 167). N. M. B.

Luminous discharge in nitrogen in presence of sodium chloride. G. DÉJARDIN (Compt. rend., 1939, **208**, 510—512).—A discharge in N_2 (1 mm.) in an electrodeless SiO_2 tube containing NaCl gives a spectrum containing the 1, 2, and $4P$ N_2, N_2^+, $NO\gamma$, CN, and N II systems, and the D lines, D_2 being abnormally intense. Small amounts of free Na are produced by the discharge. The presence of active N is suggested. At 8 mm. pressure the CN bands are absent; the $1P$, $2P$, and $NO\gamma$ intensities are augmented, and those of $4P$, N_2^+, and the D lines are reduced. A. J. E. W.

Intensity distribution and half-width value of neon lines especially at low temperature. K. KRÄMER (Physikal. Z., 1939, **40**, 81—90).—The intensity distribution and half-width vals. of the yellowish-red Ne lines (5852—6678 A.) have been determined at liquid air temp. Lines due to a combination with an unstable s_2 term have a larger half-width val. than those involving the metastable s_3, s_4, and s_5 terms. The dispersion width of the s_3, s_4, and s_5 lines is very small. The natural width of the s_2 lines is <7 mA. A. J. M.

Isotope displacement in the neon spectrum. H. SCHOBER (Physikal. Z., 1939, **40**, 77—81).—The isotopic displacement of a large no. of lines in the Ne spectrum has been recorded with particular reference to lines with high principal quantum nos. A. J. M.

Dissymmetry of intensity in the light emission of neon and argon positive rays. H. ANGENETTER and H. VERLEGER (Physikal. Z., 1939, **40**, 113—116). —The dissymmetry of the intensity of the Ne and A lines was determined for the positive rays of these elements in tubes containing H_2 and He. The dissymmetry was always >1. The effect depends on the type of line. For Ne lines $1s_i-2p_k$ ($i = 2$—5, $k = 2$—9) with He as colliding gas, the ratio I_{45}/I_{135} (I = intensity at angles given) is 1.2—1.3, and with H_2 as colliding gas it is 1.2—1.7. In agreement with former experiments on the polarisation of the light emission of positive rays, the effect in H_2 is $>$ in He.

With A, the intensity in H_2 was very small. For the A spark lines of λ 4266—4880 A. and He as colliding gas, $I_{45}/_{135}$ was 1·08—1·50 except for the $4s^2D_3$—$4p^2F_4$ line where the polarisation ($I_{\|}/I_{\perp}$) was 1·00 and I_{45}/I_{135} was 0·95. The polarisation was smaller for H_2 than for He as colliding gas. Similar results were obtained for some arc lines of A, of which three were investigated. A. J. M.

(A) **Quadratic Zeeman effect.** F. A. JENKINS and E. SEGRÈ. (B) **Theory.** L. I. SCHIFF and H. SNYDER (Physical Rev., 1939, [ii] **55**, 52—58, 59—63).—(A) Using a cyclotron magnet, the Zeeman effects of the principal series lines of Na and K in the range $n = 10$—35 were observed in absorption. For $n = 12$—20, all components show an increasing displacement, $\propto H^2$, towards short $\lambda\lambda$. This quadratic Zeeman effect is measured and compared with theory for the first time, and shows good agreement as far as $n = 20$. Perturbation effects for $n > 20$ are described and discussed. Beyond $n = 28$ the broadening increases until the lines are no longer distinguishable at $n = 35$. All the effects are compared with the theory given below. (B) A mathematical theory is developed and considered in relation to experiment. N. M. B.

Absorption of sulphur vapour in the visible [spectrum]. (MLLE.) N. MORGULEFF (Compt. rend., 1939, **208**, 273—275).—$\nu\nu$ of absorption max. are tabulated. The attribution of the bands to the $^3\Sigma$—$^3\Sigma$ system of S_2 (Rosen and Neven, A., 1938, I, 285) is confirmed. Pronounced perturbations occur for high vals. of ν'. A. J. E. W.

Sensitised fluorescence of potassium. E. H. KRAUSE (Physical Rev., 1939, [ii], **55**, 164—169).—The fluorescence radiation resulting when a mixture of K and Hg vapours was irradiated with light from a water-cooled Hg arc contained K lines as well as two of the three known K_2 absorption bands and a new band with a max. at 5721 A. Elimination of the fluorescence by exposing the mixture to light from a hot Hg arc or to light from which all $\lambda\lambda < 2800$ A. had been filtered indicated that the excitation was caused by absorption of 2536 A. by the Hg. Energy considerations show that the K ions were formed by collisions of the second kind between normal atoms of one kind and excited atoms of another kind. Further evidence that K ions were formed was the large increase in intensity of the K fluorescence when a hot filament to supply electrons was introduced into the fluorescing region, the intensity increasing with filament temp. N. M. B.

Hyperfine structure of Mn I and nuclear magnetic moment. R. A. FISHER and E. R. PECK (Physical Rev., 1939, [ii], **55**, 270—276; cf. White, A., 1930, 970).—From available data and new measurements of the structure of the green lines of Mn I, 24 hyperfine interval factors are determined. Formulæ for these, derived by the method of energy sums, are in fair accord with much of the data. The approx. magnetic moment of ^{55}Mn is 3·0 nuclear magnetons. N. M. B.

Molecular spectrum of selenium. B. ROSEN (Physica, 1939, **6**, 205—218).—The absorption and emission spectra of Se_2 have been re-investigated. Data are recorded for the principal system, probably $^3\Sigma$—$^3\Sigma$, to which all the bands between 2800 and 5200 A. belong, except the broad diffuse bands in the visible. Predissociation occurs in the bands $v' = 10$—14 and > 22. L. J. J.

Effect of solvents on the continuous absorption spectrum of bromine. R. G. AICKIN, N. S. BAYLISS, and A. L. G. REES (Proc. Roy. Soc., 1938, **A**, **169**, 234—245).—The visible and ultra-violet absorption spectrum of Br was studied in the following solvents : H_2O ($2N$-H_2SO_4), cyclohexane, $CHCl_3$, CCl_4, C_6H_6, PhCl, PhMe. The weak ultra-violet absorption of gaseous Br is increased, particularly by the aromatic solvents. A displacement of the max. is also observed. G. D. P.

"Forbidden" lines in the Te I spectrum. H. NIEWODNICZAŃSKI and F. LIPIŃSKI (Nature, 1938, **142**, 1160).—The forbidden lines 5420, 4309, and 7909 A. in the Te I spectrum are obtained in the electrodeless discharge of Te vapour of suitable concn. heated to 900° in presence of He, and especially of A. In absence of He or A, only the line 5420 A. is obtained. The measured $\lambda\lambda$ agree with those calc. from the known vals. of spectral terms. L. S. T.

Spectrum of tellurium in the extreme ultra-violet. L. BLOCH and E. BLOCH (Compt. rend., 1939, **208**, 336; cf. A., 1937, I, 335).—$\lambda\lambda$ and intensities of 108 lines (110—233 A.) in the spectrum of an electrodeless discharge in Te vapour are tabulated. A. J. E. W.

Second spectrum of xenon. C. J. HUMPHREYS (J. Res. Nat. Bur. Stand., 1939, **22**, 19—53).—Between 2200 and 10,200 A. the spectrum of Xe excited in condensed Geissler-tube discharges contains $\sim$2600 lines. Of these lines 1200 belong to Xe II, and their $\lambda\lambda$ and relative intensities are recorded. 633 lines are classified as transitions between 103 energy levels, 75 of which are identified with quantum nos. and electron configurations. W. R. A.

Hyperfine structure of gold. R. M. ELLIOTT and J. WULFF (Physical Rev., 1939, [ii], **55**, 170—175).—Investigations in the region 2300—6300 A. showed splitting for > 8 lines of Au I, but no resolution of Au II lines. From the four-component structure of the lines 4437 and 4607 A. the nuclear moment is 3/2; the magnetic moment determined from the splitting of the unreversed resonance line 2428 A. is 0·195 nuclear magneton. The estimated splitting of the $^2P_{1/2}$ level is in approx. agreement with that calc. from the $^2S_{1/2}$ level. No indication of any abnormally large $^2P_{1/2}$ separation or of any isotope shift was found. N. M. B.

Merging of spectral lines in radiation from the high-pressure mercury discharge in relation to power, pressure, and tube diameter. J. KERN and P. SCHULZ (Z. Physik, 1939, **111**, 454—466).—Merging of the lines 5770/91, 3650/55/63, 5461, and 4358 A. was followed through alterations in the power dissipated, diameter of tube, pressure, and temp. and width of the arc. Results are discussed. H. C. G.

Discharge potential of pure mercury vapour. R. GRIGOROVICI (Z. Physik, 1939, **111**, 596—616).—

Discharge potentials for Hg vapour between plane parallel electrodes are measured using Pt, Fe, Al, and Hg as cathode. Conditions in the vapour and at the cathode surface are discussed. L. G. G.

Effect of magnetic field on mercury discharge radiation. II. V. FABRIKANT and G. ROCHLIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 437—440; cf. A., 1938, I, 486).—Longitudinal magnetic fields cause the Hg discharge column to contract in diameter. The calc. max. density of electrons lies at some distance from the axis of the discharge. J. A. K.

Far ultra-violet spectrum of thallium. L. BLOCH, E. BLOCH, and R. WALDEN (J. Phys. Radium, 1939, [vii], **10**, 49—59).—The $\lambda\lambda$ and relative intensities of the lines found in the ultra-violet spectrum of Tl between 1400 and 200 A. are listed. The majority are due to Tl IV and higher orders, whilst the rest are due to Tl II and Tl III. W. R. A.

Tables facilitating calculation of line absorption coefficients. F. HJERTING (Astrophys. J., 1938, **88**, 508—515). L. S. T.

Perturbations between Σ-terms of different multiplicity. A. BUDÓ and I. KOVÁCS. **Perturbations between Σ-terms of like multiplicity. I.** KOVÁCS (Z. Physik, 1939, **111**, 633—639, 640—649).—Continuations of work already noted (A., 1938, I, 383). L. G. G.

Electron temperature, T_e, in an alternating-current positive column discharge (50 periods per second). Results for neon. W. UYTERHOEVEN and C. VERBURG (Compt. rend., 1939, **208**, 269—271; cf. A., 1939, I, 114).—The variation of T_e with the phase angle is parallel to that of the p.d. across the discharge tube. T_e varies slightly with the distance from the axis of the column. A. J. E. W.

Electric sparks and their use for the excitation of spectra. H. KAISER and A. WALLRAFF (Ann. Physik, 1938, [v], **34**, 297—340).—The spark discharge of a Feussner spark-producing circuit (A., 1933, 920) has been investigated by cathode-ray oscillograph and by rotating mirror. The greater part of the radiation of metal particles is produced in clouds of metal which evaporate from the electrodes after the first discharge and are afterwards uninfluenced by the discharge. The suitability of various types of discharge for spectral analysis is discussed. O. D. S.

Ignition process of the electric discharge at atmospheric pressure. R. SCHADE (Z. Physik, 1939, **111**, 437—449).—Theoretical. The Townsend theory of discharge inception is in contradiction to the measurements of Schöfer. An alternative mechanism is advanced; it involves ionisation in the gas space with liberation of electrons. Electronic collision produces light which is absorbed at the cathode surface with liberation of further photo-electrons. H. C. G.

Excitation of atoms in a rare-gas discharge. V. FABRIKANT and K. PANEVKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 441—444).—A discussion of the cause of the max. which is observed in the concn. of excited atoms in a rare-gas discharge when the c.d. is increased. J. A. K.

Atmospheric [light] absorption. I. (MME.) A. VASSAY and E. VASSAY (J. Phys. Radium, 1939, [vii], **10**, 75—81).—A detailed account of work already noted (cf. A., 1938, I, 433). W. R. A.

Development of the spark discharge. II. T. E. ALLIBONE and J. M. MEEK (Proc. Roy. Soc., 1938, **A**, **169**, 246—268; cf. A., 1939, I, 3).—Previous work is extended to pressures of air between 76 and 0·3 cm. Hg. The discharge is photographed with a rotating camera and simultaneous records of the voltage and current are made by the use of a high-speed cathode-ray oscillograph. A no. of new features of the negative discharge are observed, and the effect of a series resistance in the gap is investigated. G. D. P.

Excitation of light by ionic and atomic collision. W. MAURER (Physikal. Z., 1939, **40**, 161—181).—A review dealing principally with the form of excitation functions for ionic and at. collisions, excitation of light by protons, by the H and D isotopes, and by alkali ions, and the accuracy of the spin maintenance law for collisions. A. J. M.

Fe III lines in stellar spectra. P. SWINGS and B. EDLÉN (Astrophys. J., 1938, **88**, 618—621).—A term analysis of the Fe III spectrum in the ultra-violet has been made. Several Fe III lines are present in B-type stars, in both emission and absorption. The $4s^7S$ level is $\sim$29,500 cm.$^{-1}$ above the ground level, giving an ionisation energy of $\sim$30·3 e.v. from the ground level a^5D. L. S. T.

Red auroral lines on September 14—16th. C. STÖRMER (Nature, 1939, **143**, 117).—Spectrograms showing fairly strong auroral lines and bands with the 6300 A. line several times as strong as the green line 5577 A. in some cases, are reproduced. L. S. T.

Theory of the colours of reflexion nebulæ. L. G. HENYEY and J. L. GREENSTEIN (Astrophys. J., 1938, **88**, 580—604).—The properties of small particles are derived from the Mie theory. The observed dependence of the extinction coeff. on λ can be explained by the presence of metallic particles or of a mixture of dielectric particles of various sizes. The albedo of metallic particles is small and $\propto \lambda$, providing a possible test for the existence of metallic substances in space. L. S. T.

Physical processes in gaseous nebulæ. V. Electron temperatures. J. G. BAKER, D. H. MENZEL, and L. H. ALLER (Astrophys. J., 1938, 88, 422—428; cf. A., 1939, I, 56). L. S. T.

Fine structure of the X-ray absorption edges of aluminium and zinc. J. E. JOHNSTON (Proc. Camb. Phil. Soc., 1939, **35**, 108—113).—The absorption curves of Al and Zn foils (10^{-4}—10^{-5} cm. thick) obtained by evaporating the metal in vac. on a layer of celluloid (about 40 A. thick) are obtained for $\lambda\lambda$ between 100 and 220 A. A condensed spark between Cu electrodes was used as a radiation source because the continuous X-radiation in this region is of very low intensity. The fine structure of the Al L_{23} ($\lambda_{max.}$ 170·5 A.) and Zn M_{23} ($\lambda_{max.}$ 139·0 and 143·9 A.) absorption edges are recorded. F. J. L.

X-Rays emitted in the discharge between external electrodes by sustained waves. L.

GROVEN (Compt. rend., 1939, **208**, 182—183).—A high-frequency electrodeless discharge in Hg vapour emits X-rays, which are shown by absorption measurements to have $\lambda = 5.7$A., in approx. correspondence with the Hg $M\alpha_1$ and $M\beta_1$ lines. On reducing the distance between the electrodes λ changes abruptly to 3·5 A.   A. J. E. W.

Secondary emission of beryllium. R. WARNECKE and (MLLE.) M. LORTIE (Compt. rend., 1939, **208**, 429—432).—The secondary emission coeffs. (δ) of thick Be layers condensed on Ag, Cu, Ni, Ta, and Mo have been studied. The max. coeff. (δ_M) before heat-treatment shows wide variations with the nature of the support. On heating δ_M increases steadily, and after long heating (40 hr.) at 700—850°, reaches a stable val., independent of temp. (50—800°), which depends on the support and the previous history of the specimen.   A. J. E. W.

Surface and volume photo-electric emissions from barium. R. J. CASHMAN and E. BASSOE (Physical Rev., 1939, [ii], **55**, 63—69).—Spectral sensitivity measurements for 5000—2300 A. were made on Ba surfaces prepared by fractional distillation in a "gettered" vac., and results, compared with the predictions of a modification of Mitchell's square-top barrier theory, show good agreement for observed yields in the range 5000—3000 A. At 2967 A. there is an abrupt rise in the experimental curve, attributed to the onset of the vol. photo-electric effect, and continuing to the limit of the measurements. The calc. threshold (2950 or 3100 A.) for the vol. effect agrees well with experiment.   N. M. B.

Spark breakdown potentials as a function of the product of the pressure by the plate separation in argon, nitrogen, and hydrogen for platinum and sodium cathodes. (MISS) F. EHRENKRANZ (Physical Rev., 1939, [ii], **55**, 219—227). —Sparking potential curves for an extended range of pressures are given and discussed in detail. In all cases the sparking potentials were lower for a Na-coated Pt cathode than for a clean Pt cathode.   N. M. B.

Origin of emission centres on the surface of oxide cathodes. W. HEINZE and S. WAGENER (Z. tech. Physik, 1939, **20**, 16—26).—The emission from cathodes covered with a mixture of rare-earth oxides has been observed by means of an electron microscope, and the variation with previous treatment in the no. and position of emission centres followed. It is concluded that the formation of the centres is not due to gaseous or other impurities, or to variations in the thickness and porosity of the oxide layer, but is connected with the roughness and the crystal orientation of the layer.   O. D. S.

Radius of the electron. J. YVON (Compt. rend., 1939, **208**, 432—434).—Theoretical.   A. J. E. W.

Electron temperature (T_e) in an alternating current (50 cycles per second) positive column discharge. Measurements in a neon–sodium mixture (sodium-vapour lamps). W. UYTERHOEVEN and C. VERBURG (Compt. rend., 1939, **208**, 503—506; cf. A., 1939, I, 114).—The variation of T_e with the phase angle and with the distance from the walls of the discharge tube is studied and discussed.   A. J. E. W.

Interchange energy of two free electrons. C. A. LUDEKE (Physical Rev., 1939, [ii], **55**, 315).—Mathematical.   N. M. B.

Absence of polarisation in electron scattering. M. E. ROSE and H. A. BETHE (Physical Rev., 1939, [ii], **55**, 277—289).—Mathematical. In an attempt to explain the discrepancy between Mott's theory and observed results on the polarisation of electrons in double scattering, the depolarising effect of multiple elastic scattering, of inelastic scattering with spin change of the incident electron, and of exchange scattering in which the exchanged electrons have opposite spins is investigated.   N. M. B.

Primary ionisation with fast electrons in nitrogen. M. D. BORISSOV, V. P. BRAILOVSKI, and A. I. LEIPUNSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 110—113).—The primary ionisation produced by fast electrons in N_2 has been investigated by the cloud chamber method. The curve of ionisation against electron velocity is of the same shape as that given by the theoretical expression derived on the basis of quantum mechanics and relativity by Bethe *et al.* for primary ionisation in at. H.   A. J. M.

Ionisation and excitation in mercury vapour produced by electron bombardment. W. B. NOTTINGHAM (Physical Rev., 1939, [ii], **55**, 203—219). A special apparatus for determining ionisation and excitation in Hg vapour and allowing evaluation of the electron energy from an accurately known magnetic field and the dimensions of the ion chamber is described and tested. The ionisation probability function has important max. at 10·8 and 32 v., composite character is shown by detailed structure over 10·4—16 v., and the smooth trend of the curve above 16 v. indicates freedom from complication for high-energy electrons. The study of photo-electric currents gave new data on the electronic excitation function of the $2^3P_1{}^0$, $3^3P_1{}^0$, and $4^3P_1{}^0$ levels of the Hg atom, showing that these have max. in their probability functions at 5·6, 8·9, and 9·6 v.   N. M. B.

Probability of ionisation of mercury atoms by collision with low-velocity electrons. M. E. BELL (Physical Rev., 1939, [ii], **55**, 201—202).—In view of divergent data as to the true form of the ionisation probability curve in the neighbourhood of the ionisation potential (cf. Lawrence, A., 1927, 85; Smith, A., 1931, 665) curves for the electron velocity distribution and for the positive ion current showing the onset of ionisation were obtained. Results are in good agreement with those of Lawrence.   N. M. B.

Wave functions for negative ions of sodium and potassium. D. R. HARTREE and W. HARTREE (Proc. Camb. Phil. Soc., 1938, **34**, 550—558).—Solution of Fock's equation for the self-consistent field with exchange indicates that the negative ions Na^- and K^- can exist, and that they are stable and not liable to autoionisation. The wave functions of these negative ions are required in the calculation of at. cross-sections for the capture of electrons by neutral atoms.   F. J. L.

Straggling of electrons due to radiation and ionisation loss. H. C. CORBEN (Proc. Camb. Phil. Soc., 1938, **34**, 540—549).—Theoretical. The probability of an electron having an energy > a certain fraction of its initial energy after traversing a certain thickness of matter is calc. for different vals. of the initial energy.   F. J. L.

Spectrum of Ra-C positrons. A. I. ALICHANOV and G. LATISCHEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 429—430).—Positrons from Ra-C were deflected in a magnetic spectrograph and the intensity distribution was measured by a counter method. Eleven steps in the distribution curve were observed.   J. A. K.

Property of air ionised by X-rays. G. REBOUL and F. PERRIER (Compt. rend., 1939, **208**, 172—173). —Weak ionisation persisting for several hr. after irradiation is ascribed to large ions of low mobility formed at active centres in the gas.   A. J. E. W.

Formation of large ions in gases as a function of the size of the particles in suspension. O. TE-TCHAO (Compt. rend., 1939, **208**, 271—273).—The product of the proportions of large positive and negative ions in the suspended particles is a const., independent of the particle size, so long as the mobility is negligible in comparison with that of ordinary ions. The proportion of large negative ions increases with the particle size.   A. J. E. W.

Collisions of doubly positive ions. F. WOLF (Ann. Physik, 1939, [v], **34**, 341—358; cf. A., 1938, I, 222).—The collision processes $A^{++} \rightarrow A$ and $A^{++} \rightarrow H_2$ have been investigated. In order to determine whether charge transfer takes place with transference of one or two charges, cross-sections calc. on each of these assumptions are compared with the resonance curves obtained previously (A., 1937, I, 542). It is concluded that for $A^{++} \rightarrow A$, double transfer takes place under strict resonance. For $A^{++} \rightarrow H_2$ it is probable that single charge transfer without excitation of the colliding mols. is the most frequent process but that single charge transfer with excitation of one mol. also occurs. Effective cross-sections for $A^{++} \rightarrow A$ and $Ne^{++} \rightarrow Ne$ have been measured. In both cases the variation with velocity is in accordance with the assumption of collisions under strict resonance.   ·O. D. S.

Ionic recombination in air. J. SAYERS (Proc. Roy. Soc., 1938, **A**, **169**, 83—101).—Up to 1 atm. the recombination coeff. varies with pressure in the manner predicted by theory. Its apparent variation with the ionisation intensity is ascribed to the formation of complex ions, such as O_3. The new vals. of the recombination coeff. are used to calculate the ion density and electrical conductivity at various levels of the lower atm. up to 17 km. The results are in agreement with direct observation.   G. D. P.

Ninth Report of the Committee on At. Wts. of the International Union of Chemistry. G. P. BAXTER, M. GUICHARD, O. HÖNIGSCHMID, and R. WHYTLAW-GRAY (J.C.S., 1939, 351—356, and J. Amer. Chem. Soc., 1939, **61**, 223—228).—Work on the determination of the at. wts. of C, N, F, P, Rb, Ru,

Nd, Eu, and Pb is described. The at. wt. of P has been changed from 31·02 to 30·98.   E. S. H.

At. wt. of lutecium. Analysis of lutecium trichloride. O. HÖNIGSCHMID and F. WITTNER (Z. anorg. Chem., 1939, **240**, 284—288).—A Lu prep. containing 1·18% of Yb but free from other rare earths was converted into chloride and the ratios $LuCl_3 : 3Ag : 3AgCl$ were determined, giving, after correction for the Yb content, 174·986 for the at. wt. of Lu. After a discussion of other determinations, it is concluded that the most probable val. is 174·99. $LuCl_3$ has ρ_4^{25} 3·98.   F. J. G.

Atomic structure and the periodic table. R. L. EBEL (J. Chem. Educ., 1938, **15**, 575—577).— The elements are arranged in three levels according to the position of the differentiating electron in the outer, the second, and the third electron shells from the outside of the atom.   L. S. T.

Chemical separation of nuclear isomerides. E. SEGRÈ, R. S. HALFORD, and G. T. SEABORG (Physical Rev., 1939, [ii], **55**, 321—322).—Available methods and their mechanism are discussed. When the isomeride in the upper state decays to the lower state the nucleus emits a γ-ray and recoils; if the recoil energy (for elements of medium and high at. wt.) is insufficient to break the chemical bond, the recoil from the conversion electron may be > that from the corresponding γ-ray so that the necessary energy is obtained, or an activated condition may be created in the mol. which may undergo chemical reaction on collision with some artificially introduced mol. The application of this principle to the separation of the 18-min. and 4·4-hr. isomerides of ^{80}Br is described.   N. M. B.

Isotope of lutecium. J. MATTAUCH and H. LICHTBLAU (Z. Physik, 1939, **111**, 514—521).—The isotope of Lu previously revealed by the splitting of hyperfine structure is shown by the mass spectrograph to be $^{176}_{71}Lu$. The recently discovered natural activity of Lu is probably due to this isotope. Photometric measurements give the relative abundance of $^{175}Lu : ^{176}Lu = 100 : 2·58 \pm 0·07$. With the new Dempster val. for the packing fraction of Lu, the at. wt. is $174·99(5) \pm 0·01$ in agreement with Hönigschmid's val. 174·99 (cf. A., 1938, I, 5). An upper limit for the abundance of an isotope ^{174}Lu is estimated at 0·45% and for any other isotopes 0·4%.   H. C. G.

Isotope of lutecium. H. SCHÜLER and H. GOLLNOW (Z. Physik, 1939 **111**, 521—522; cf. A., 1937, I, 57).—The discrepancy between the vals. for the relative abundance of $^{176}_{71}Lu$ as obtained from the mass spectrograph and from the hyperfine structure measurements is explained by inaccuracy in the val. for the mechanical nuclear moment of $^{176}_{71}Lu$. Nuclear moments of the two isotopes are discussed.   H. C. G.

Isotopic constitution of (I) uranium, and the half-lives of the uranium isotopes, (II) radiogenic leads, and the measurement of geological time. A. O. NIER (Physical Rev., 1939, [ii], **55**, 150—153, 153—163).—I. A mass-spectrographic determination of abundance ratios gave $^{238}U/^{235}U = 139 \pm 1\%$ and $^{238}U/^{234}U = 17,000 \pm 10\%$.

No other isotopes were found. From these ratios and Kovarik's α-particle counts (cf. A., 1932, 790) and the assumption that the Ac series is 4·6% as active as the U, the calc. decay consts. are : U_I 1·520 × 10⁻¹⁰, U_{II} 2·6 × 10⁻⁶, and AcU 9·72 × 10⁻¹⁰ year⁻¹. The corresponding half-lives are 4·56 × 10⁹, 2·7 × 10⁵, and 7·13 × 10⁸ years respectively.

II. Mass-spectrometric determinations of the isotopic constitution of 21 samples of radiogenic Pb are correlated with analysis data for the parent minerals. The Ac-D/Ra-G ratios (²⁰⁷Pb/²⁰⁶Pb ratios corr. for common Pb contamination) agree with a 4·6 rather than a 4% val. for the ratio of the Ac/U series activity. Results indicate that AcU was far less abundant in early geologic time than has been generally supposed. A discussion of measurement of geologic age from Ac-D/Ra-G ratios shows that, in the event of mineral alteration, the ages obtained are more reliable than those from Pb/U ratios. The relatively small amount of ²⁰⁴Pb in samples containing a large amount of Th indicates that it is very unlikely that ²⁰⁸Pb decays to ²⁰⁴Pb.   N. M. B.

Element 87 derived from actinium. (MLLE.) M. PEREY (Compt. rend., 1939, **208**, 97—99).—A radio-element with a β-activity of period 21±1 min. has been detected in the disintegration products of Ac. The element is co-pptd. with Cs, and is evidently an isotope of element 87, formed by α-emission from Ac (also observed, range 3·5 cm. in air at n.t.p.).   A. J. E. W.

Photographic sensitometry for beta-ray spectra. H. BRINKMAN, L. S. ORNSTEIN, and W. LANGENDIJK (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 1051—1054).—In the β-ray spectrum of a radioactive substance, application of a homogeneous electric field between the source and the slit of the spectrograph causes a decrease in the energy of the electrons; consequently the spectrum is displaced. From comparison of the shifted and unshifted spectra on a photographic plate, the energetic sensitivity of the plate can be determined. The sensitivity of the plate in the region 100—200 ke.v. is independent of the energy.   W. R. A.

Absorption method of investigating the primary β-particles from radioactive substances. N. FEATHER (Proc. Camb. Phil. Soc., 1938, **34**, 599—611).—The max. energy and some indication of the energy spectrum of β-rays from any radio-element may be obtained, by means of an absorption method, using the β-radiation of Ra-E as a standard of comparison. The method is applicable to weak sources, and has been applied to U-X_2, ²⁴Na, ¹⁰⁸Ag, and ³²P. A modified empirical range–energy relation is given.   F. J. L.

β-Ray spectrum of Ra-C and energy levels of excitation of Ra-C' nucleus. A. I. ALICHANIAN and S. J. NIKITIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 28—30).—The β-ray spectrum of Ra-C is studied in the range 300—3175 e.kv. by the magnetic focussing method, and consists of two elementary spectra with upper limits of 3175 and 1600 e.kv. (cf. Ellis and Mott, A., 1933, 1100).   F. J. L.

Elastic scattering of fast β-particles by atomic nuclei. F. C. CHAMPION and A. BARBER (Physical Rev., 1939, [ii], **55**, 111; cf. A., 1939, I, 52).—Data obtained with a cloud chamber on the elastic scattering of β-particles of energy 0·7—1·2 Me.v. by I nuclei show that the scattering is ≯ half that predicted by Mott's theory. Causes of the discrepancy are discussed.   N. M. B.

Conditions for the quantitative operation of a Geiger–Müller counter for β-rays. Ionising power of β-rays as a function of their velocity. L. S. ORNSTEIN, J. M. W. MILATZ, H. TEN KATE, and M. MIESOWICZ (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 1055—1057).—N, the no. of kicks, has been determined as a function of the pressure, p, of gas in a Geiger–Müller counter using electrons of magnetically defined velocity v. N increases with p according to $N_p = N_\infty\ (1 - e^{-\alpha p})$, where α is a const., finally attaining a saturation val. at high pressures. A theoretical discussion of N–p dependence indicates that α is a function of v, and that the true no. of incident electrons is represented by N_∞ in the equation. In quant. β-spectra work it is therefore essential to maintain a saturation pressure ($N \sim N_\infty$), or to determine N_p and obtain N_∞ from the formula.   W. R. A.

Value of $G^2|M|^2$ in the theory of the β-spectra. E. F. M. VAN DER HELD (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 1094—1095).—A theoretical attempt to explain why the log of the calc. vals. of the Fermi const. (log $G^2|M|^2$), plotted as a function of Z, do not lie on Sargent curves.   W. R. A.

Energies of the soft β-radiations of rubidium and other bodies. W. F. LIBBY and D. D. LEE (Physical Rev., 1939, [ii], **55**, 245—251; cf. A., 1934, 1150).—A method for measuring the upper limits of soft β-spectra by the use of screen wall tube counters filled with H_2 is described, and results are given for ⁸⁷Rb, ²²Na, ³⁵S, and ¹⁹⁸Au.   N. M. B.

Relation between range and energy for the upper limits of β-ray spectra. E. E. WIDDOWSON (Proc. Physical Soc., 1939, **51**, 19—25).—The linear relation $R = 0.460E_K - 0.226$, connecting the max. range R in g. per sq. cm. with the Konopinski–Uhlenbeck upper limit E_K in Mv. for continuous β-ray spectra, is obtained from experimental results, and results showing large deviations from it are discussed. The range–energy relation, obtained quantum-mechanically, is plotted for electrons in Pb, Al, and air, and is found to be linear in the region considered. Reasons for differences between the theoretical and empirical relations are suggested.   N. M. B.

β-Radioactivities of rhenium. K. SINMA and F. YAMASAKI (Physical Rev., 1939, [ii], **55**, 320).—Re bombarded with slow neutrons from Be + D and fast neutrons from Li + D showed, in both cases, activities of half-life 16 hr. and 90 hr., respectively. The corr. ratios of the initial intensities, $R = (I_{90}/I_{16})$ were 1·2 for slow and 17 for fast neutrons, indicating, contrary to Pool (cf. A., 1937, 1, 490), that the 16-hr. activity is due to ¹⁸⁸Re and the 90-hr. to ¹⁸⁶Re. Energy spectra of these activities studied by the cloud chamber show that both emit electrons and the energy upper limits were 1·2 for ¹⁸⁶Re and 2·5 Me.v. for ¹⁸⁸Re.

    N. M. B.

β-Rays of mesothorium 1 and radium *D*.
D. D. LEE and W. F. LIBBY (Physical Rev., 1939, [ii], 55, 252—258).—Mesothorium 1 prepared from an old sample of pure Th(SO$_4$)$_3$ and free from active contamination was shown by magnetic deflexion and Al absorption experiments to emit electrons of max. energy 53±4 e.kv. The momentum of the most energetic conversion β-ray of 0·3%-pure Ra-*D* was 765±32, and the upper limit of the continuous spectrum of 0·3%-pure Ra-*E* was 5150±250 gauss cm. The apparent upper limit of the primary β-ray spectrum of Ra-*D* was 546±10 gauss cm., or 25·5±1·0 e.kv. The estimated observed no. of secondary β-rays arising from the conversion of the 47·2 e.kv. γ-rays of Ra-*D* indicates the emission of 5—10 such electrons per 100 disintegrations. Results are compared with available data and disagreements are explained.　　N. M. B.

Upper limit of the β-spectrum of Th-*C″* and Th-*B*. A. ZAVELSKY (Physical Rev., 1939, [ii], 55, 317).—The interpretation of the terms of the Konopinski–Uhlenbeck equation and the determination of the rest mass of the neutrino from the difference between the experimental and theoretical upper limit of the β-spectrum (cf. Lyman, A., 1937, I, 107) are examined with the help of experimental and theoretical plots for Th-*C″* and -*B*.　　N. M. B.

Absorption coefficient of 5·8-Me.v. γ-radiation in aluminium. J. HALPERN and H. R. CRANE (Physical Rev., 1939, [ii], 55, 258—259).—Using a method such that all quanta scattered >10° in the Al are excluded from the data (cf. Delsasso, A., 1937, I, 212), the coeff. found is 0·075±0·009 cm.$^{-1}$ Deduction of the theoretical val. of the pair absorption coeff. gives the Klein–Nishina absorption coeff. 0·062±0·009 cm.$^{-1}$, in good agreement with theory.　　N. M. B.

Pair internal conversion coefficient in the F + H′ reaction and measurements on the γ-ray spectrum. J. HALPERN and H. R. CRANE (Physical Rev., 1939, [ii], 55, 260—262).—The γ-radiation from F + H′, studied by the cloud-chamber method, consists of a single line at 5·8 Me.v. The group of electrons at ~4 Me.v. (cf. A., 1937, I, 592) was confirmed, and shown to consist probably of the negative members of internal conversion pairs. The measured coeff. for pair internal conversion was ~1 pair per 100 γ-ray quanta, and is > the theoretical val. No trace was found of γ-radiation down to 0·5 Me.v. or of delayed emission of electrons by the CaF$_2$ after bombardment.　　N. M. B.

Excitation of γ-radiation in processes of proton capture by light elements. S. C. CURRAN, P. I. DEE, and V. PETRŽÍLKA (Proc. Roy. Soc., 1938, A, 169, 269—289).—The excitation functions for the γ-radiations emitted in the process of proton capture by Be, B, C, and F have been determined for energies of the incident protons from 0 to 10^6 e.v. Several new resonance peaks are reported. The yield of γ-radiation was measured in the case of ^{12}C and ^{13}C.　　G. D. P.

3·2-Me.v. γ-radiation from the excited Th-*D* nucleus. G. STETTER and W. JENTSCHKE (Physikal. Z., 1939, 40, 104—107).—Investigation of the nuclear photo-effect with D when bombarded with γ-rays from the excited Th-*D* nucleus indicates the existence of radiation of energy 3·2 Me.v. The ratio of the no. of protons produced by the 2·62-Me.v. radiation to that by the 3·2-Me.v. radiation is 100 : 1·8. The small intensity of the 3·2-Me.v. radiation can be explained from a consideration of the term scheme of the Th-*D* nucleus, which indicates that for this radiation a spin change of 3 units is necessary.　　A. J. M.

Absolute output of radiation caused by electrons moving within a medium with super-light velocity. P. A. TSCHERENKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 116—121).—The abs. output of radiation per millicurie of Ra emanation when H$_2$O was bombarded with β-particles from Ra-*B* + *C* was found to be 4·1 × 10^{-4} erg per sec. The val. calc. from the theory of Tamm and Frank is 3·5 × 10^{-4} erg per sec. The agreement with theory is also satisfactory for C$_6$H$_6$, C$_6$H$_{12}$, CS$_2$, Bu$^\beta$OH, and CCl$_4$.　　A. J. M.

Charge of radium-*A* and of other short-life atoms resulting from radium emanation. Significance of measurements by Gerdien's method. G. ALIVERTI (Atti. R. Accad. Sci. Torino, 1936, 71, I, 432—442; Chem. Zentr., 1937, i, 519; cf. A., 1936, 951).—The active products are incompletely removed from filtered air containing Rn by Gerdien's method; the deactivation curves usually represent decay of Ra-*A* + *B* + *C*. Ra-*A* is almost completely pptd. in a flow method using a negatively charged collector.　　A. J. E. W.

Cosmic rays and radioactive potassium. W. R. SMYTHE (Physical Rev., 1939, [ii], 55, 316).—From a specimen of rock obtained from the greatest depth of a deep granite formation, a sample of KCl was prepared and subjected to comparison counts for activity against pure KCl. Results indicate that the amount of ^{40}K formed from ^{39}K by cosmic rays is negligible and probably zero.　　N. M. B.

Anomalous scattering of neutrons by helium. H. STAUB and W. E. STEPHENS (Physical Rev., 1939, [ii], 55, 131—139).—The ratio of the cross-sections for elastic backward scattering of neutrons in He and H$_2$, measured as a function of neutron energy, has an almost const. val. ~1·3 for 2—6-Me.v. neutrons, but at 1 Me.v. the ratio increases to ~9. This anomaly must be caused by resonance scattering occurring from the formation of an unstable compound nucleus ^{5}He (cf. Williams, A., 1937, I, 593).　　N. M. B.

Absorption of slow neutrons of different energies by boron, cobalt, and manganese. E. O. SALANT, W. J. HORVATH, and H. I. ZAGOR (Physical Rev., 1939, [ii], 55, 111—112).—Absorption coeffs. with various detectors are tabulated and discussed.　　N. M. B.

Scattering of D–D neutrons. S. KIKUCHI and H. AOKI (Physical Rev., 1939, [ii], 55, 108—109).—Results previously reported for 21 elements (cf. A., 1938, I, 488) are extended with higher accuracy to 37 elements. There is evidence that scattering cross-section plotted as a function of at. no. gives a smooth irregular curve.　　N. M. B.

Binding energy of the deuteron. F. T. ROGERS, jun., and (Mrs.) M. M. ROGERS (Physical Rev., 1939,

[ii], 55, 106).—Investigation of the disintegration of D by the 2·623-Me.v. γ-radiation from the decay of Th-C'' gives the val. 2·17$_4$ Me.v. for the binding energy of the deuteron, in good agreement with available data (cf. Bethe, A., 1938, I, 172; Richardson, *ibid.*, 170). N. M. B.

γ-Radiation from boron bombarded by deuterons. E. R. GAERTTNER, W. A. FOWLER, and C. C. LAURITSEN (Physical Rev., 1939, [ii], 55, 27—30).— Using a method previously described (cf. A., 1938, I, 290), the γ-ray spectrum from B + D was obtained by observing the positron–electron pairs ejected from a thin Pb lamina and the recoil electrons from a C lamina. Quantum energies and relative intensities of γ-ray components are obtained, and an attempt is made to correlate these with those of the proton and neutron groups. N. M. B.

Neutron–proton scattering cross-section. V. W. COHEN, H. H. GOLDSMITH, and J. SCHWINGER (Physical Rev., 1939, [ii], 55, 106).—Since the cross-section for the scattering of thermal neutrons by free protons cannot be found directly by measurements on paraffin, an experiment depending on the existence of resonance levels in the region 1—10 e.v., to determine the neutron–proton scattering cross-section, is described. A Rn-Be source of homogeneous neutrons with filter and detector films of Rh were used. The mean free path of Rh resonance neutrons in paraffin was 0·56 cm., giving $20 \times 10^{-24} \pm 10\%$ sq. cm. for the cross-section. Results are in agreement with those of neutron scattering in *o*- and *p*-$\bar{H}_2$ (cf. Brickwedde, A., 1938, I, 548). N. M. B.

Resonance absorption of slow neutrons in indium. J. H. MANLEY, H. H. GOLDSMITH, and J. SCHWINGER (Physical Rev., 1939, [ii], 55, 107).— Since ^{115}In shows strong absorption for neutrons of about 2 e.v., giving rise to two β-active periods of 13 sec. and 54 min., the self-absorption curve for thicknesses of In up to 1·3 g. per sq. cm., using the 54-min. activity of a thin In foil indicator, was determined. The val. deduced for the resonance cross-section is $> \sim 20{,}000 \times 10^{-24}$ sq. cm. N. M. B.

Capture of neutrons by atoms in a crystal. W. E. LAMB, jun. (Physical Rev., 1939, [ii], 55, 190—197).—Mathematical. Generalised calculations to include the effect of lattice binding show that for sufficiently weak binding the absorption curve has the same form as for a gas, not at the crystal temp., but at a temp. corresponding with the average energy per vibrational degree of freedom of the lattice (including zero-point energy). N. M. B.

Isotope shift of spectral lines and the interaction of neutrons with electrons. I. TAMM (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 106—109).—The larger isotope shifts are due to some difference in the field of the various isotopes in the neighbourhood of the nucleus. This is probably due to a short-range interaction of electrons with the additional neutrons in the nuclei. As the negative shifts of the lighter elements must also be explained in this way, the force must be equiv. to an attraction between neutrons and electrons. This is treated mathematically. Spin interaction cannot account for the fact that the components of spectral lines corresponding with odd isotopes are usually nearer to the components of the next lighter isotope than to those of the next heavier one. The interaction between neutrons and electrons assumed implies the possibility of the creation of a positron–electron pair. A. J. M.

Scattering of neutrons in ferromagnetics. A. MIGDAL (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 551—553).—Theoretical. The cross-section does not depend on the magnetic nature of the neutron. L. J. J.

Angular distribution of the disintegration products of light elements. R. O. HAXBY, J. S. ALLEN, and J. H. WILLIAMS (Physical Rev., 1939, [ii], 55, 140—146).—Angular distributions for the range of angles 45—150° and for 100—200 kv. bombarding voltages were investigated for the following reactions: ^{6}Li + ^{2}H → 2^4He; ^{2}H + ^{2}H → ^{3}H + ^{1}H; ^{11}B + ^{1}H → ^{8}Be + ^{4}He; ^{11}B + ^{1}H → 3^4He. Only the first reaction showed spherical symmetry, and in the other cases distribution expressions are found. N. M. B.

Disintegration of boron by protons. E. L. HILL and R. O. HAXBY (Physical Rev., 1939, [ii], 55, 147—149; cf. preceding abstract).—A discussion of measurements on the angular distribution of the α-particles arising from the bombardment of B by protons suggests that the particles from the continuous distribution which show an angular distribution have a common origin with the particles in the homogeneous group at 44 mm., and that this latter group may not be truly homogeneous, but may arise from a peculiarity of the three-particle disintegration. N. M. B.

Mass difference $^9_4$Be — $^8_4$Be; stability of $^8_4$Be. S. K. ALLISON, (MISS) E. R. GRAVES, L. S. SKAGGS, and N. M. SMITH, jun. (Physical Rev., 1939, [ii], 55, 107).—The energy spectrum of deuterons from a thick Be target under proton bombardment was obtained. The mass difference is $1·00720 \pm 0·00003$, and the binding energy of the odd neutron in $^9_4$Be is $1·65 \pm 0·05$ Me.v. Calculations on the stability of $^8_4$Be are made; $^8_4$Be is stable with respect to two α-particles by $0·31 \pm 0·06$ Me.v. N. M. B.

Production of the long-lived radioactive cobalt isotope from nickel bombarded by fast neutrons. O. VIKTORIN (Proc. Camb. Phil. Soc., 1938, 34, 612—613).—The Ni container surrounding a neutron source (100 mg. of Ra and Be powder) was active; the activity, after fast initial decay, remained const. for a month. The presence of a long-lived Co isotope, produced by fast neutrons, is indicated. F. J. L.

Radioactive isotopes of copper, zinc, gallium, and germanium. R. SAGANE (Physical Rev., 1939, [ii], 55, 31—38).—Full data and decay curves for active isotopes obtained by bombardment with fast and slow neutrons or by deuteron bombardment are reported. The isotopes and half-lives observed are: Ni, 63 ($2·5 \pm 0·3$ hr.); Cu, 62 ($10 \pm 0·5$ min.), 64 ($12·8 \pm 0·3$ hr.), 66 (5 ± 1 min.); Zn, 63 (35 ± 3 min.), 65 (210 ± 30 min.), 69 (57 ± 3 min.); Ga, 68 (66 ± 2 min.), 70 (20 ± 1 min.), 72 ($14·1 \pm 0·2$ hr.), 74? (6 ± 1 day); Ge, 69 (30 ± 3 min.), 71 (26 ± 3 hr.), 75 (81 ± 3 min.), 77 (8 ± 1 hr.); As, 71 (50 ± 3 hr.), 73 (88 ± 2

min.), 74 (16±2 day), 77 (55±5 day). No trace was found of ^{61}Cu (3·5 hr.) or of a 23 hr. period in neutron bombardments of Ga. N. M. B.

Artificial radioactivity produced by protons. L. A. DELSASSO, L. N. RIDENOUR, R. SHERR, and M. G. WHITE (Physical Rev., 1939, [ii], 55, 113—121). —The products of bombardment of Cu, Ni, Ag, Cr, and Mo targets by 4-Me.v. protons were investigated. In Cu, the (p, n) reaction gives ^{63}Zn (38·5 min.; upper limit of positron spectrum 1·8 Me.v.) and ^{65}Zn. Provisional assignments of two Cu isotopes, both emitting positrons, when Ni is bombarded with protons, are ^{58}Cu (81 sec.) and ^{60}Cu (7·9 min.). Also produced in Ni are ^{61}Cu, by both the (p, n) and (p, γ) reaction (threshold <1·8 Me.v.), and ^{64}Cu, by the (p, n) reaction (threshold ~2·1 Me.v.). Identity is discussed for a Cd isotope (6·7 hr.; threshold 2·4 Me.v.) arising from proton bombardment of Ag, and emitting very soft negative electrons (probably conversion electrons of a nuclear γ-ray). Cr gives ^{51}Mn (40 min.), emitting positrons. Three unassigned activities (45 min., 2·7 hr., and 36·5 hr.) are produced in Mo; the last emits negative electrons. N. M. B.

Self-diffusion in copper. B. V. ROLLIN (Physical Rev., 1939, [ii], 55, 231).—After bombarding Cu with 8-Me.v. deuterons in the cyclotron and heating the Cu in a quartz tube in a furnace for 40 hr., the penetration of ^{64}Cu (12·8 hr.) was investigated by measuring the activities of successive sections cut from the specimen. Distribution of activity accorded with the diffusion equation, and the vals. found for the diffusion coeff. at 1030° and 940° are 2·8 × 10⁻⁹ and 3·5 × 10⁻¹⁰ sq. cm. per sec., respectively. The activation energy for the diffusion process is ~60,000 g.-cal. per mol. N. M. B.

Radioactivity induced in molybdenum by deuterons. B. N. CACCIAPUOTI (Nuovo Cim., 1938, 15, 425—426).—The presence of a γ-component with a half-life period of 62 days is recorded in the radiation emitted from Mo bombarded with deuterons in a cyclotron. O. J. W.

Radioactive isotopes of element 43. B. N. CACCIAPUOTI (Physical Rev., 1939, [ii], 55, 110; cf. A., 1938, I, 113).—Using a Mo sample which had been bombarded with deuterons in a cyclotron, absorption curves in Al, measured over long periods, for the radiation emitted by element 43 were obtained. A γ-component of half-val. period 62 days was found. N. M. B.

γ-Radioactivity of 4·5 hours. ^{80}Br from radio-bromate. D. C. DE VAULT and W. F. LIBBY (Physical Rev., 1939, [ii], 55, 322; cf. Segrè, A., 1939, I, 169).—Investigations of the neutron-capture γ-ray recoil are extended by a study of growth and decay curves of BrO_3^- and Br^- as the former is purified from Br^- by pptn. as AgBr. N. M. B.

Widths of nuclear energy levels. J. H. MANLEY, H. H. GOLDSMITH, and J. SCHWINGER (Physical Rev., 1939, [ii], 55, 39—46).—In order to obtain information on the levels of the compound nucleus responsible for the 44 sec. period of Rh, neutron absorption measurements with Rh as absorber and detector are analysed. The analysis gives 6100 × 10⁻²⁴ sq. cm. for the capture

cross-section at resonance, 0·17 e.v. for the total width, and 1·6 × 10⁻³ e.v. for the neutron width. N. M. B.

Nuclear isomerism produced by X-rays with a continuous spectrum. B. PONTECORVO and A. LAZARD (Compt. rend., 1939, 208, 99—101).— Activity with a period of 3·9±0·5 hr., ascribed to a metastable state of ^{115}In, has been induced in In by bombardment with X-rays of max. energy 1850 kv. This provides a case of "nuclear fluorescence" excited by X-rays. A. J. E. W.

Radioactivity induced by nuclear excitation. I. Excitation by neutrons. M. GOLDHABER, R. D. HILL, and L. SZILARD. **II. Excitation by protons.** S. W. BARNES and P. W. ARADINE (Physical Rev., 1939, [ii], 55, 47—49; 50—52).—I. An investigation of the radioactivity produced in In by neutrons having different energy distributions and of the chain reactions produced in Cd by fast neutrons shows that the 4·1-hr. period of In (cf. Lawson, A., 1937, I, 594) can be produced by nuclear excitation of In by 2·5-Me.v. neutrons and is attributed to an excited metastable state $^{115*}In$ of the stable ^{115}In. Radioactive ^{115}Cd of 2·5 days half-life, produced by neutron loss from ^{116}Cd and by neutron capture from ^{114}Cd, transforms with emission of negative electrons into $^{115*}In$.

II. $^{115*}In$ (4·1 hr.) is produced by proton bombardment of In and is formed by a new type of proton excitation process. It is not formed by proton bombardment of Cd. The cross-section for 5·8-Me.v. protons is ~10⁻²⁹ sq. cm. N. M. B.

Resonance levels for neutron capture of iodine and indium. J. HORNBOSTEL and F. A. VALENTE (Physical Rev., 1939, [ii], 55, 108).—Apparent transmission curves for neutrons in I and In as a function of thickness of C, Fe, and Pb used as slowing substances between absorber and detector are given and discussed. Min. in the curves indicate at least four levels for I and approx. vals for the half-widths of levels are computed. N. M. B.

Sensitive method for measuring the excitation function of artificial radioactivity. L. S. ORNSTEIN, J. M. W. MILATZ, E. F. M. VAN DER HELD, and W. MAAS (Proc. K. Akad. Wetensch. Amsterdam, 1938, 41, 1049—1050).—The artificial radioactivity of a Th prep. (10⁷ α-particles per sec.) has been investigated as a function of the energy of the α-particles. The method, which is described, is based on reactions occurring on the walls of a Geiger–Müller counter. $^{27}_{13}Al + ^4_2He \rightarrow ^{30}_{15}P + ^1_0n$, $^{30}_{15}P \rightarrow ^{30}_{14}Si + {}^+e$. The sensitivity is due to the fact that the full mass of the wall acts on the counter. The time of decay for different energies of α-particles is const. (3·4 min.). W. R. A.

Secondary γ-radiation of high energy induced by β-rays from uranium-X and radium-E. E. STAHEL and P. KIPFER (Helv. Phys. Acta, 1936, 9, 492—506; Chem. Zentr., 1937, i, 518).—Ionisation chamber measurements show that the intensity of the induced γ-radiation (I) is ∝ the at. no. of the bombarded element. Max. I vals. occur for γ-ray energies of 0·5 (Ra-E) and 0·8 Me.v. (U-X), I for the latter energy representing 1·9% of the available β-ray

energy. U-X and Ra-E emit inhomogeneous γ-radiation due to internal retardation of β-particles, I being $<$ that obtained by external retardation in Pb.
                A. J. E. W.

Detection of the production of active barium isotopes from uranium and thorium by irradiation with neutrons. Detection of further active products by the disintegration of uranium. O. HAHN and F. STRASSMANN (Naturwiss., 1939, **27**, 89—95).—The products of irradiation of U and Th by neutrons have been shown to be radioactive isotopes of Ba by a method making use of radioactive indicators. The at. wts. of the isotopes are discussed. Some of the Ba isotopes obtained from U are identical with those from Th. It is considered that the " trans-U " elements previously obtained have been given their correct at. nos.. Further disintegration products of U are found to be Sr and Yt. An inert gas and an alkali metal (either Xe and Cs, or Kr and Rb) have also been detected.   A. J. M.

Experimental proof of the explosive rupture of uranium and thorium nuclei under the action of neutrons. F. JOLIOT (Compt. rend., 1939, **208**, 341—343).—Neutrons from a Rn–Be source in a brass cylinder were used to irradiate a coating of U oxide on the exterior surface; after the irradiation the interior surface of a concentric bakelite cylinder, 3 mm. from the oxide layer, carried activities corresponding with those induced in U by neutron bombardment, and ascribed previously (A., 1938, I, 593; 1939, I, 116) to rare- and alkaline-earth elements. The effect is attributed to disintegration of U nuclei by neutrons, with production of lighter nuclei (*e.g.*, ^{141}Cs and ^{98}Rb) which are projected from the U with a range in air of $\sim$3 cm. and subsequently undergo β-ray changes. Similar phenomena are observed with Th, but not with Pb.   A. J. E. W.

Radioelements formed in uranium and thorium irradiated with neutrons. (MME.) I. CURIE and P. SAVITCH (Compt. rend., 1939, **208**, 343—346).— The rare-earth element (period 3·5 hr.) induced in Th by neutron bombardment is associated closely with La on fractional pptn. of the oxalates, and is therefore not an Ac isotope; it is probably identical with an element formed in U under similar conditions. Neutron bombardment of U also affords an alkali metal of period 18 min. These products may be formed by disruption of U and Th nuclei (cf. preceding abstract).   A. J. E. W.

Mesotron as the name of the new particle. R. A. MILIKAN (Physical Rev., 1939, [ii], **55**, 105).— General support of the name " mesotron " for the penetrating cosmic-ray particle is reported.
                N. M. B.

Emission and absorption of heavy electrons. H. S. W. MASSEY and H. C. CORBEN (Proc. Camb. Phil. Soc., 1939, **35**, 84—94).—The cross-sections for " photo-electric " absorption of heavy electrons by a bound nuclear particle and for emission of a heavy electron by a free nuclear particle on collision with a nucleus are calc. approx. to be $\sim$10^{-26} sq. cm. for heavy electrons with energies up to 10^8 e.v., but probably decreases rapidly at higher energies, and

10^{-29} sq. cm. respectively. The latter phenomenon is unlikely to be observed in a cloud chamber. F. J. L.

Probable emission of mesotrons in certain nuclear disintegrations. M. E. NAHMIAS (Compt. rend., 1939, **208**, 339—340).—It is suggested that a weak but highly-penetrating radiation from intense Ra sources screened with Pb consists of mesotrons or protons of very high velocity. These are probably produced by spontaneous nuclear disintegrations yielding energies of $\sim$100 Me.v.; they are not caused by neutron emission as the intensity is not increased by mixing the Ra source with Be.   A. J. E. W.

Existence of penetrating neutral particles. F. R. SHONKA (Physical Rev., 1939, [ii], **55**, 24—27).— A Rossi–Hsiung type experiment (cf. A., 1934, 1285) performed at 14,200 ft. altitude indicates the production of barytrons by non-ionising particles which must be much more penetrating than photons. This high penetrating power suggests their identification with Heitler's neutrettos (neutral particles having mass and other properties similar to the barytron).
                N. M. B.

Detection of mesotrons in cosmic radiation with compensation for air pressure. W. KOLHÖRSTER and I. MATTHES (Physikal. Z., 1939, **40**, 142—143).—The air pressure effect on cosmic radiation is an absorption effect for the soft component, but has little effect on the hard component. This behaviour is connected with the radioactive nature of the component produced from mesotrons. The air pressure effect may be regarded as the effect of the spontaneous disintegration of these particles, and disintegration time and mean free path of the mesotrons can be calc. on this basis. The vals. obtained are in good agreement with those deduced by other methods.   A. J. M.

Total intensity of ultra-radiation in the atmosphere. R. AUER (Z. Physik, 1939, **111**, 559—587). —The accuracy of measurement of ionising powers of ultra-radiation with balloon electrometer is discussed and the data for seven ascents between 1934 and 1937 are given. From a comparison of intensity curves obtained at different points on the earth, the variation of the latitude effect with height is determined.
                L. G. G.

Showers of cosmic radiation in the stratosphere. E. REGENER and A. EHMERT (Z. Physik, 1939, **111**, 501—507).—Measurements were made with a balloon apparatus carrying 4 counter tubes under 1 cm. Pb up to heights corresponding with 40 mm. Hg. Above heights corresponding with 350 mm. Hg, the curves for the shower frequency and for the soft vertical component coincide.
                H. C. G.

Heavy electrons in cosmic rays. V. VEKSLER, K. ALEXEEVA, and N. REINOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 122—125).—Experiments with heavy electrons in cosmic rays were carried out with proportional counters. To determine the dependence of the no. of heavy electrons on altitude measurements were made at 3000, 4200, and 5300 m. above sea-level. This dependence on altitude coincides with that of the hard component of cosmic rays. The appearance of strongly ionising particles

is not connected with the formation of showers. Heavy electrons are in equilibrium with the penetrating component of cosmic rays. The origin of heavy electrons is discussed. The hypothesis is advanced that they are formed by penetrating particles with the help of an intermediate non-ionising radiation.   A. J. M.

Penetrating power of cosmic-ray shower particles. L. JÁNOSSY (Proc. Camb. Phil. Soc., 1938, 34, 614—619).—The absorption curve for cosmic-ray shower particles has been observed in Pb and Fe, and it is concluded that the showers are nearly all of the cascade type. Attempts to observe penetrating particles in cosmic-ray showers at sea-level have been unsuccessful.   F. J. L.

Nature of the penetrating cosmic rays. V. C. WILSON (Physical Rev., 1939, [ii], 55, 6—10; cf. A., 1938, I, 225).—Geiger–Müller tube experiments at depths of 30 and 300 m. H_2O equiv. from the top of the atm. showed that in each case the observable cosmic rays were penetrating ionising rays accompanied by soft showers. The ratio of soft showers to penetrating rays increased with depth.   N. M. B.

Latitude effect of cosmic rays. B. GROSS (Physical Rev., 1939, [ii], 55, 112).—From the existence of a " critical latitude " evidence is deduced that the hard component of cosmic rays is probably of primary origin.   N. M. B.

Galactic rotation and the intensity of cosmic radiation at the geomagnetic equator. M. S. VALLARTA, C. GRAEF, and S. KUSAKA (Physical Rev., 1939, [ii], 55, 1—5; cf. Compton, A., 1935, 911).—If cosmic radiation is of extra-galactic origin there should be, in consequence of the rotation of the galaxy, a small diurnal variation of intensity depending on sidereal time. This variation and its sidereal time max. are calc. for cosmic rays arriving vertically at the geomagnetic equator for various proportions of positive to negative primaries.   N. M. B.

Critical analysis for sidereal time variations of cosmic rays on the Pacific. J. L. THOMPSON (Physical Rev., 1939, [ii], 55, 11—15; cf. Compton, A., 1935, 911).—Mathematical (cf. preceding abstract).   N. M. B.

Penumbra of cosmic radiation. R. A. HUTNER (Physical Rev., 1939, [ii], 55, 15—23; cf. Lemaitre, A., 1936, 774).—Theory is developed and some examples of penumbral trajectories are shown. Pairs of vals. of the energy and latitude having penumbral regions are indicated. Two methods of analysing the data with the Bush differential analyser are given.   N. M. B.

Difference in the absorption of cosmic rays in air and water and the instability of the barytron. T. H. JOHNSON and M. A. POMERANTZ (Physical Rev., 1939, [ii], 55, 104—105).—From investigations of the cosmic ray intensities and zenith angle distributions through 8·9 m. of H_2O and 10 m. of air, calculations on the mean life of the barytron are reported.   N. M. B.

Large showers of cosmic rays. P. AUGER, R. MAZE, P. EHRENFEST, jun., and A. FRÉON (J. Phys.

Radium, 1939, [vii], 10, 39—48).—A detailed account of work already noted (cf. A., 1938, I, 428, 490).   W. R. A.

Decay of the penetrating cosmic rays. E. M. BRUINS (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 54—60).—Mathematical.   W. R. A.

Number of secondary electrons accompanying the penetrating component of cosmic rays in different materials. J. CLAY and F. J. H. DUVERGÉ (Physica, 1939, 6, 171—173).—Threefold coincidences under 25 cm. Fe and either 50 cm. H_2O, 10 cm. Pb, or 24 cm. Fe differed by 4·5%, 3%, and 3·8%, respectively, with and without 5 cm. Pb between the counters. Under 10 m. H_2O the difference was 2%.   L. J. J.

Decay of the penetrating cosmic radiation in different directions. J. CLAY, K. H. J. JONKER, and J. T. WIERSMA (Physica, 1939, 6, 174—176).—The decrease produced by a layer of Fe is greater for vertically incident radiation than at 30° and 45° to the vertical. The penetrating particles decay with a mean life-time of 4×10^{-6} sec. There is no asymmetry around the vertical.   L. J. J.

Penetrating cosmic radiation in water and rock down to 450 m. of water. P. H. CLAY, A. VAN GEMERT, and J. CLAY (Physica, 1939, 6, 184—204).—Counter and ionisation measurements in the Sörfjord near Bergen are described. For depths (h) of 60—450 m., the primary intensity $\propto h^{-1·93\pm0·01}$, in agreement with earlier results in water and rock. For h 10—60 m., the decrease is smaller owing to decay of particles of lower energy, with a mean life-time $\sim 2 \times 10^{-6}$ sec. for $3—12 \times 10^9$ e.v. The results are consistent with the view that the penetrating component consists of barytrons.   L. J. J.

Soft shower-producing component of cosmic radiation. N. S. IVANOVA (Compt. rend. Acad. Sci., U.R.S.S., 1938, 20, 529—532).—The ratio of the intensities produced by equiv. thicknesses of Pb and Al is 3·6, instead of ~ 15 according to the Bethe–Heitler theory. The discrepancy disappears if the soft component is regarded as mainly secondary and in equilibrium with the penetrating component.   L. J. J.

Possible source of the soft cosmic radiation at sea-level. B. FERRETTI (Nuovo Cim., 1938, 15, 421—424).—The energy distribution of the cosmic radiation at sea-level is calc. on the assumption that it arises from the disintegration of a mesotron with a half-life $\sim 10^{-6}$ sec. into an electron and a neutrino.   O. J. W.

Penetrating component of cosmic radiation and Rossi curve. N. S. IVANOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 533—536).—Interposition of layers of Al between a thick Pb filter and the Pb screen above the counters increases the soft radiation observed. The Rossi curve is largely due to transitions of the penetrating component, i.e., the soft radiation is largely of secondary origin.   L. J. J.

Magnitude of the sun, the stellar temperature scale, and bolometric corrections. G. P. KUIPER (Astrophys. J., 1938, 88, 429—471).   L. S. T.

Collapsed neutron stars. F. ZWICKY (Astrophys. J., 1938, **88**, 522—525).—Consequences of the hypothesis that certain stars and cores of stars are composed mainly of neutrons are discussed. L. S. T.

Simple applications of the Proca potential. D. IVANENKO (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 31—33).—Mathematical. Proca's equations are applied to the spin of the mesotron. The upper limit for its mass is 600 × mass of an electron, and its radius is 10^{-15} cm. This is inadmissibly small and leads to the rejection of the hypothesis of the semi-heavy nature of heavy mass. F. J. L.

Extinction of discharges in Geiger–Müller counters. A. N. MAY (Proc. Physical Soc., 1939, **51**, 26—32).—The discharges are discussed in terms of the Townsend theory. The discharge consists of a series of electron avalanches, each generated from photo-electrons ejected from the outer wall by the previous one. At low currents the average no. of photo-electrons per avalanche is small, and if the actual no. for an avalanche falls to zero the discharge will stop. N. M. B.

Integration of the equation of radiative transfer [in the formation of absorption lines]. P. SWINGS and L. DOR (Astrophys. J., 1938, **88**, 516—521). L. S. T.

Nature of the heavy electron. A. SOKOLOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 34).—The heavy electron is considered to be a complex particle consisting of an electron and a neutrino. F. J. L.

Physical state of interstellar gas clouds. O. STRUVE (Proc. Nat. Acad. Sci., 1939, **25**, 36—43).—The effect of the discovery of new interstellar absorption lines (cf., *e.g.*, A., 1937, I, 158) on the computation of electron density in interstellar space is discussed. The abundance of H is $\sim 10^6$ times that of Ca and Na, and ρ is 3×10^{-25} g. per c.c. for the interstellar gas. L. J. J.

Measurement of e/m_0 for β-particles of Ra-C. A. I. ALICHANOV, A. I. ALICHANIAN, and M. KOZODAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 427—428).—Results of measurements of e/m_0 prove that if any heavy electrons of mass 2 to 5 m_0 are emitted during β-disintegration of Ra-*C* and -*E* their no. is <0·5%. J. A. K.

Theory of elementary particles. P. JORDAN (Z. Physik., 1939, **111**, 498—500).—The possibility of the electron and neutrino being the primary constituents of heavy elementary particles is discussed. H. C. G.

Field theory of elementary particles. N. ROSEN (Physical Rev., 1939, [ii], **55**, 94—101).—Mathematical. The construction of a classical field theory of the electron, combining gauge-invariance and freedom from singularities, is developed by the introduction of new matter functions similar to the wave functions of the quantum theory. N. M. B.

Characteristic energy of the electron. A. MERCIER (Helv. Phys. Acta, 1939, **12**, 55—75).—Mathematical. A. J. M.

Entropy of Fermi–Dirac gas. F. C. AULUCK (Phil. Mag., 1939, [vii], **27**, 370—374).—The entropy of the gas is calc. to the second order of approximation. D. F. R.

Mass of the neutrino. J. SOLOMON (J. Phys. Radium, 1939, [vii], **10**, 104).—A study of the laws of transformation of the neutron into a proton leads to a finite val. for the mass of the neutrino. W. R. A.

Algebraic theory of spin. J. L. DESTOUCHES (J. Phys. Radium, 1939, [vii], **10**, 105—112).—Mathematical. W. R. A.

Atomic absorption coefficients and transition probabilities [in cæsium]. F. L. MOHLER (Nature, 1938, **142**, 1160—1161). L. S. T.

Statistical mechanism of nuclear collisions. L. GOLDSTEIN (J. Phys. Radium, 1939, [vii], **10**, 23—29).—Mathematical. W. R. A.

Structure of the proton and neutron. G. BECK (Compt. rend., 1939, **208**, 332—333).—Mathematical. A. J. E. W.

Asymptotic oscillations within the helium atom. D. BUCHANAN (Trans. Roy. Soc. Canada, 1938, [iii], **32**, III, 53—64).—Theoretical. The He atom is considered as a three-body system on the basis of Newtonian mechanics. L. J. J.

Binding energy of 4n-nuclei on the α-particle model. B. O. GRÖNBLOM and R. E. MARSHAK (Physical Rev., 1939, [ii], **55**, 229—230; cf. Hafstad, A., 1939, I, 6).—Mathematical. The ${}^8_4$Be anomaly is examined. N. M. B.

Electrical quadrupole moment of the deuteron. J. M. B. KELLOGG, I. I. RABI, N. F. RAMSEY, jun., and J. R. ZACHARIAS (Physical Rev., 1939, [ii], **55**, 318—319).—The mol. beam magnetic resonance method applied to H_2 and D_2 shows close groups of sharp resonance min. When the theory of the H_2 min. is applied to D_2 the displacements of the min. are only one sixth of the experimental vals., and this effect can be accounted for by the presence of an electrical quadrupole moment in the deuteron. Similar experiments on the proton and deuteron in HD prove that the large displacements are of nuclear rather than of mol. origin. The calc. quadrupole moment is $\sim 2 \times 10^{-27}$ sq. cm., and its sign is probably positive. N. M. B.

Binding energy of the deuteron. F. T. ROGERS, jun., and (MRS.) M. M. ROGERS (Physical Rev., 1939, [ii], **55**, 263—269; cf. Richardson, A., 1938, I, 170; Bethe, *ibid.*, 172).—The method used is relatively insensitive to uncertainties in the energy–range relation for protons of low energy. The protons, produced by the disintegration of Th-*C''* γ-radiation, were observed in a low-pressure cloud chamber in a strong magnetic field, and the corresponding kinetic energies were calc. from the curvatures of the tracks. The binding energy found is 2·17±0·05 Me.v., in fair agreement with available vals. N. M. B.

Iteration method and its application to the oxygen problem. C. HORVAY (Physical Rev., 1939, [ii], **55**, 70—87).—Mathematical. Since available calculations for nuclei heavier than He lead to approx.

binding energies < the experimental vals., an examination of the Hamiltonian and the convergence of the variation or perturbation methods used is developed.   N. M. B.

Computation of the energy of repulsion. M. MAMOTENKO and A. SCHUCHOVITZKI (Acta Physicochim. U.R.S.S., 1938, **9**, 803—804).—Mathematical. A simplified method of calculating the repulsion of two particles in quantum mechanics is described and applied to two H atoms with parallel spins and two He atoms.   C. R. H.

Internal conversion coefficients. S. M. DANCOFF and P. MORRISON (Physical Rev., 1939, [ii], **55**, 122—130).—Mathematical. The internal conversion of nuclear γ-rays is treated by methods suited to the cases of the artificially radioactive elements.
                                    N. M. B.

Intensities of electronic transitions in molecular spectra. III. Organic molecules with double bonds. Conjugated dienes. R. S. MULLIKEN (J. Chem. Physics, 1939, **7**, 121—135).—Intensity calculations have been applied to the spectra of org. compounds containing conjugated or resonating double linkings, in particular the conjugated dienes. The strong absorption characteristic of such compounds is due probably to an $N \rightarrow V$ transition (homopolar normal state $\rightarrow$ ionic excited state) similar to those identified for O_2, C_2H_4, etc. (cf. A., 1939, I, 111). Four $N \rightarrow V$ transitions occur for the unsaturation electrons (electrons which make the weaker linking in double linkings) with vv independent of the shape of the mol. but of different intensities for cis- and trans-forms. The intensity for the latter tends to concentrate in the long λ at the expense of the short-λ $N \rightarrow V$ transitions. Experimental data on diallyl and rubber agree with the theoretical conclusions that the ultra-violet spectra of unconjugated dienes and polyenes should be similar to those of the alkenes. Conjugation causes an increase in the total absorption intensity per double linking (especially in trans-forms), and also a scattering of the vv of the four $N \rightarrow V$ transitions towards longer and shorter $\lambda\lambda$ as compared with the alkenes. These theoretical predictions agree well with available data on the ultra-violet spectra of dienes if it is assumed that butadiene and its derivatives exist in the trans-form, with its centrally substituted derivatives partly in the cis-form.   W. R. A.

Ultra-violet dispersion frequencies of the alkali hydrides. W. RAUCH (Z. Physik, 1939, **111**, 650—656).—A method for the production of thin layers of alkali hydrides in a suitable absorption vessel is described. The measured absorption spectra are fundamentally similar to those of the alkali halides, and the positions of their max. may be calc. from the empirical formula of Hilsch and Pohl.   L. G. G.

Processes of molecular formation with and without Boltzmann distribution and the conversion of translational into rotational energy. H. SCHÜLER, H. GOLLNOW, and H. HABER (Z. Physik, 1939, **111**, 484—494).—Spectra emitted by the discharge from cooled hollow cathodes in rare gas containing a little H_2 indicate that CuH mols. are formed

in a rotationless state, whereas AlH mols. formed under comparable conditions have a Boltzmann distribution corresponding with 1800° K. These results and the transformation of translational into rotational energy by collision of the hydride mols. with rare gas atoms are discussed.   H. C. G.

Explanation of the phenomenon characterised as " pressure effect " in the spectrum of aluminium hydride. H. SCHÜLER, H. GOLLNOW, and H. HABER (Z. Physik, 1939, **111**, 508—513).—The no. of rotation lines in the spectrum of AlH increases with increasing pressure. Contrary to previous assumptions of predissociation and mol. formation in the gas space, intensity distribution at the lowest pressures indicates the formation of AlH on the Al surface followed by sputtering or evaporation of the hydride mols. with low rotational energy but high translational energy. The mols. acquire increased rotational energy by collision, as is the case with CuH (cf. preceding abstract).   H. C. G.

Ultra-violet absorption of nitrous acid. H. W. THOMPSON (J. Chem. Physics, 1939, **7**, 136).—The criticisms by Newitt and Outridge (A., 1939, 1, 57) of the hypothesis of Melville and Wulf (A., 1936, 135) do not appear to be completely warranted.
                                    W. R. A.

Rotational analysis of the ultra-violet bands of germanium monoxide. A. K. S. GUPTA (Proc. Physical Soc., 1939, **51**, 62—68).—Full data for rotational analyses of the (1, 0), (2, 0), and (0, 3) ultraviolet bands of GeO are tabulated. The bands are due to a $^1\Sigma \rightarrow {}^1\Sigma$ transition, and mol. consts. for both states are found. A few lines due to the less abundant ^{70}GeO and ^{72}GeO (cf. Jevons, A., 1937, I, 596) were observed in the (0, 3) band.   N. M. B.

Spectral distribution of the absorption coefficient in X-rayed sodium chloride crystals in the case of disappearance of inner tensions. I. KIRVALIDZE (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 543—544).—Superficial dissolution of NaCl crystals coloured by X-rays removes internal strains and produces a shift in the absorption max. from λ 463 to 455 mμ., and similarly removes a shift to longer $\lambda\lambda$ produced by excitation with λ 465 mμ.
                                    L. J. J.

Absorption spectrum of praseodymium salts. P. LEHMANN (Ann. Physik, 1939, [v], **34**, 389—392; cf. Spedding et al., A., 1937, I, 393).—The absorption spectra, in very thin layers, of $Pr(EtSO_4)_3,9H_2O$, $Pr(BrO_3)_3,9H_2O$, $(C_6H_3Br_2 \cdot SO_3)_3Pr,9H_2O$,   and $Pr_2(SO_4)_3,8H_2O$ have been measured. $\lambda\lambda$ of a no. of newly resolved lines are tabulated.   O. D. S.

Influence of temperature on the absorption spectra of solid solutions of samarium. O. BLANK (Acta Physicochim. U.R.S.S., 1938, **9**, 103—110).—A new band of Sm ɪᴠ, not observed at low temp., has been detected in $Na_2B_4O_7$ solutions at 250°. Its origin is discussed. The absorption bands of Sm and Nd broaden with rise of temp.
                                    W. R. A.

Absorption spectrum and life-time of the carbon sulphide radical. V. KONDRATEEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 547—548).—

Bands are recorded for absorption at room temp. which conflict with Crawford and Shurcliff's analysis of the emission spectrum. The life-time of CS is several min. L. J. J.

Ultra-violet spectrum of thiophosgene. V. HENRI and J. DUCHESNE (Nature, 1939, **143**, 28—29). —The absorption spectrum of $CSCl_2$ is characterised by five fundamental frequencies, 1148 and 537 cm.$^{-1}$ for the normal mol., and 914, 240, and 400 cm.$^{-1}$ for the activated state. The frequencies calc. for the normal mol. agree with those obtained by Thompson (A., 1939, I, 9) from the Raman spectrum. The results support the Herzberg–Teller theory, and justify the use of isotope effects in studying complex spectra. L. S. T.

Band spectrum of silicon monosulphide and its relation to the band spectra of similar molecules. R. F. BARROW and W. JEVONS (Proc. Roy. Soc., 1938, A, **169**, 45—65).—The prep. of SiS by the action of CS_2 on excess of Si at 1000° is described. >70 bands are measured in the ultra-violet and about the same no. in the near ultra-violet and visible regions (cf. A., 1938, I, 341). Vibrational analysis is given and the coeffs. of the ground states and comparable excited states are compared with those of similar mols. (monoxides and monosulphides of C, Ge, Sn, and Pb). A discharge tube in which a heavy current (5 amp.) could be maintained is described. G. D. P.

Photodissociation of ICN and BrCN molecules and the transfer of rotational energy on collision of the CN radical with foreign molecules. A. JAKOVLEVA (Acta Physicochim. U.R.S.S., 1938, **9**, 665—680).—The fluorescence of CN in ICN consists of bands at 3883 and 4216 A. and is accompanied by fluorescence of I_2 mols. In the region 3900—3800 A., the I_2 mol. shows three bands with max. at 3925, 3870, and 3800 A. The photodissociation of ICN is accompanied by the formation of CN radicals in the electronic state $^2\Sigma^*$ and in the vibrational states $v' = 0, 1, 2$. The rotational energy of the CN radical for $v' = 0$ corresponds with 1140° K. In the case of BrCN, CN fluorescence shows the same groups as in the case of ICN. The magnitude of the effect of foreign gases in increasing the rotational temp. of the CN radical decreases in the order $A > N_2 = CO_2 > H_2$. C. R. H.

Arrangement of electron bands in the spectra of solutions. I. Light absorption of aromatic nitro-compounds. G. KORTÜM (Z. physikal. Chem., 1939, **42, B**, 39—66).—The relation of light absorption to chemical constitution is discussed with special reference to the absorption of light by the simpler aromatic NO_2-compounds in H_2O, HCl, or NaOH solution. W. R. A.

Absorption of violet and near ultra-violet radiation by benzaldehyde. B. SUSZ and E. BRINER (Helv. Chim. Acta, 1939, **22**, 117—120).— Absorption data and extinction coeffs. are recorded between 3818 and 4060 A. Absorption is feeble within this range. C. R. H.

Absorption spectra of benzoylformyloxindole-phenylhydrazone and some of its derivatives.

F. W. BERGSTROM and (SIR) R. ROBINSON (J.C.S., 1939, 189—195).—Solutions of arylhydrazones of benzoylformyloxindole (I) exhibit marked colour differences in different solvents. Absorption spectra of alcoholic and AcOH solutions have been examined in the visible but no definite conclusions can be reached. It is deduced that there is present a complex mixture of tautomerides characterised by different colours and that equilibria are very sensitive to changes in solvent. A modified procedure for the prep. of the phenylhydrazone of (I) is given and the following new colour changes with solvent are recorded: yellow in $NPhMe_2$, red in conc. C_5H_5N, yellow in aq. or dil. C_5H_5N, yellow in alkali and mineral acid solution, yellow in conc. aq. NH_3. It forms readily hydrolysed salts with C_5H_5N and NH_3. The prep. of m-*nitro*-, (?) m.p. 223—224°, p-*nitro*-, m.p. 224—225°, and p-*methoxy-phenylhydrazones* of (I) and their colour changes in various solvents are described. W. R. A.

Ultra-violet absorption of polycyclic hydrocarbons. H. MOHLER and J. SORGE (Helv. Chim. Acta, 1939, **22**, 229—235).—Data for *cyclo*penteno-triphenylene, 1 : 2 : 3 : 4-dibenzfluorene, methylbenz-pyrene, 7-methylnaphthafluorene, and dihydrochrysene are recorded and discussed. C. R. H.

Chemical warfare materials. XII. Light absorption of nose and throat irritants, lung poisons, and vesicants in the short-wave ultra-violet. H. MOHLER and J. SORGE (Helv. Chim. Acta, 1939, **22**, 235—239).—Absorption data for C_6H_{14} solutions of $AsPh_2Cl$, $AsPh_2\cdot CN$, $CCl_3\cdot NO_2$, $AsEtCl_2$, $AsCl_2\cdot CH:CHCl$, $AsCl(CH:CHCl)_2$, $As(CH:CHCl)_3$, and phenarsazine chloride have been obtained. C. R. H.

Ultra-violet absorption spectrum of anhydro-sarsasapogenoic acid. L. F. FIESER and R. N. JONES (J. Amer. Chem. Soc., 1939, **61**, 532).—The ultra-violet absorption max. (243 mμ.) of the acid has $\epsilon = 0.98 \times 10^4$ (cf. A., 1939, II, 31). Its Me ether acetate in abs. EtOH has a max. at 243 mμ. (log ϵ 4·13) and a subsidiary max. at 303 mμ. (log ϵ 1·86). R. S. C.

Behaviour of alkaloids to filtered ultra-violet light at varying p_H. Determination of capillary configuration. W. AWE (Pharm. Zentr., 1939, **80**, 17—21, 51—54).—Observations are made on the colour changes of chelidonium bases on addition of acid or alkali. Ultra-violet absorption data are given for some berberine derivatives. P. G. M.

OH vibration spectrum in the photographic infra-red. II. S. MIZUSHIMA, T. KUBOTA, and Y. MORENO (Bull. Chem. Soc. Japan, 1939, **14**, 15—18).— The ѵѵ of the absorption max. of the second and third overtones of the OH band of gaseous MeOH, EtOH, $Pr^\alpha OH$, $Bu^\alpha OH$, HCO_2H, AcOH, $EtCO_2H$, PhOH, o-$C_6H_4Cl\cdot OH$, o-$C_6H_4Br\cdot OH$, and $Cl\cdot[CH_2]_2\cdot OH$ are < the ѵѵ for solutions in CCl_4 by ~100 cm.$^{-1}$ The data are compared with existing dipole moment data. W. R. A.

Spectroscopic comparison of the proton-attracting properties of liquids. W. GORDY (J. Chem. Physics, 1939, **7**, 93—99).—The positions of the OD vibration band of MeOD in 27 solvents and of

D_2O in 6 solvents and the $\Delta\nu$ from the unimol. band are recorded. From the magnitude of $\Delta\nu$ the proton-attracting properties of the different solvents can be estimated. W. R. A.

Infra-red absorption of hydrogen chloride in solution. W. GORDY and P. C. MARTIN (J. Chem. Physics, 1939, **7**, 99—102).—An extension and detailed account of work already noted (A., 1938, I, 11). Solutions of HCl in $PhNO_2$, o-$C_6H_4Me\cdot NO_2$, EtOAc, Et_2O, Pr^β_2O, Bu^α_2O, and dioxan have been examined from 2·6 to 5·4 μ. The fundamental band is shifted to lower $\nu\nu$ due to H-bonding with the solvent. W. R. A.

Infra-red spectrum and molecular constants of carbon monoxide. S. E. WHITCOMB and R. T. LAGEMANN (Physical Rev., 1939, [ii], **55**, 181—183).—Data for the fundamental 4·66 μ. and first overtone bands at 2·34 μ. of CO measured under high resolution are tabulated and an expression for the lines in the positive and negative branches in both bands is found. Mol. consts. are calc. N. M. B.

Absorption spectra of nitrogen derivatives in the near infra-red. (MME.) M. FREYMANN (Ann. Chim., 1939, [x], **11**, 11—72).—A detailed account of work already noted (cf. A., 1937, I, 9, 167, 282, 344; 1938, I, 11; 1939, I, 121). W. R. A.

Infra-red absorption spectrum of amino-acids. N. WRIGHT (J. Biol. Chem., 1939, **129**, 137—141).—Infra-red absorption spectra in the range 3—24 μ. were determined for 9 different NH_2-acids (5 in both the racemic and an optically active form) in the form of a thin uniform layer of finely powdered crystals on plates of cryst. KBr. Differences in these spectra showed that the racemic form is a compound and not a mixture of the d- and l-crystals. Shifts in the position of the CO band indicated a strong interaction between CO_2H and NH_2 groups in the cryst. NH_2-acids. T. F. D.

Interaction between rotation and oscillation in deuteroformaldehyde. H. H. NIELSEN (Physical Rev., 1939, [ii], **55**, 289—293; cf. A., 1938, I, 386).—Mathematical. The unsymmetrical broadening of the Q branch towards higher frequencies in the parallel type bands near 1100 cm.$^{-1}$ in the absorption spectrum indicates convergence towards lower rather than higher frequencies, and is accounted for by taking into account an interaction between rotation and oscillation of the Coriolis type arising from the accidental degeneracy of the three vibration frequencies, belonging to three different symmetry classes, falling near 900, 1000, and 1100 cm.$^{-1}$ N. M. B.

Infra-red spectra in the 3 μ. region of naphthalene, 1- and 2-methylnaphthalene, quinoline, and *iso*quinoline : an aid to analysis. J. J. FOX and A. E. MARTIN (J.C.S., 1939, 318—322).—Absorption spectra of $C_{10}H_8$, 1- and 2-$C_{10}H_7Me$, quinoline (I), and *iso*quinoline (II) have been examined from 2·6 to 3·8 μ. in CCl_4 solution. The naphthalenes show absorption of complex structure near 3·27 μ. which arises from CH groups; the $C_{10}H_7Me$, in addition give bands up to 3·5 μ. attributable to Me groups. The spectra of (I) and (II) are sufficiently different to permit their use for identification and estimation.

O (A., I.)

1-$C_{10}H_7Me$ and (I) give spectra resembling simple C_6H_6 derivatives near 3·27 μ., whilst 2-$C_{10}H_7Me$ and (II) are more like $C_{10}H_8$. β-Substituted compounds have m.p. $< C_{10}H_8$ but considerably $>$ α-substituted compounds. W. R. A.

Constitution of boric oxide compounds. J. H. HIBBEN (Amer. J. Sci., 1938, [v], **35, A,** 113—125).—The Raman spectra of H_3BO_3, $NaBO_2$, and $Na_2B_4O_7$ as crystals and in aq. solution have been determined and compared with those of B_2O_3 and borax glasses. The results indicate that the structure of H_3BO_3 in solution is probably a plane equilateral triangle, with O located at the corners and B in the centre, although a ring structure is not excluded. $NaBO_2$ is not a linear mol., but slightly bent; it has the symmetry C_{2v}. $Na_2B_4O_7$ appears to have a chain mol. in the cryst. state, but dissociates in H_2O into H_3BO_3 and $NaBO_2$. The spectrum of borax glass resembles that of cryst. $Na_2B_4O_7$, but differs from that of B_2O_3. E. S. H.

Depolarisation measurements [of Raman lines] and the structure of some complex ions. H. J. BERNSTEIN and W. H. MARTIN (Trans. Roy. Soc. Canada, 1938, [iii], **32,** III, 43—52).—A method for measuring depolarisation factors (ρ) by means of a polarising film (" Polaroid ") is described. Results are reproducible within ±5%. HgX_4^{--} (X = Cl, Br, I) ions give only one line, for which ρ is zero, indicating completely symmetrical vibration. It is concluded that such ions do not contain four-covalent bonds, but represent mol. compounds HgX_2,X_2^{--}. L. J. J.

Raman spectrum of deuterium perchlorate. R. FONTEYNE (Natuurwetensch. Tijds., 1939, **21,** 6—8).—From a study of the Raman spectrum of conc. solutions of $HClO_4$ in D_2O it is concluded that mols. of $DO\cdot ClO_3$ (symmetry C_{3v}) exist together with mols. of the pseudo-acid $HO\cdot ClO_3$ of similar structure. S. C.

Molecular oscillation frequency in viscosity and Raman effect. L. SIBAIYA and M. R. RAO (Current Sci., 1939, **8,** 12).—The mean ratio of $\eta_{obs.}$ to $\eta_{calc.}$ for 14 org. substances is 1·08 when Lindemann's expression is applied. The existence of the Lindemann or the Debye max. frequency in scattered spectra favours the view that the low-frequency Raman lines near the Rayleigh line arise from lattice oscillations. W. R. A.

Number of Raman frequencies of the ethylenic linking. C. PRÉVOST (Compt. rend., 1939, **208,** 39—40).—Raman spectra of three isomeric forms of $CH_3\cdot[CH\cdot OH]_2\cdot CH:CH_2$ confirm the structures deduced from chemical evidence (cf. A., 1928, 1212). W. R. A.

Ethylenic [linking] frequency in vinyl ethers. A. KIRRMANN (Compt. rend., 1939, **208,** 353—355).—Vals. of the b.p., d, n, and $[R]$ are recorded for $CH_2:CH\cdot OEt$ (1611, 1635), $CHMe:CH\cdot OEt$ (1666), and $CH_2:CMe\cdot OEt$ (1654); Raman $\nu\nu$ due to the C:C linking are given in parenthesis. The OEt group increases the ν, and the suggestion that the displacement is due to polarity is not verified. A. J. E. W.

Raman effect. XCVI. Alkyl iodides. L. KAHOVEC and J. WAGNER (Z. physikal. Chem., 1939, 42, B, 123—135).—A continuous distillation apparatus has been used to determine the Raman spectra of the photosensitive iodides of Pr^a, Pr^β, Bu^a, Bu^β, sec.-Bu, Bu^γ, n-, iso-, and tert.-C_5H_{11}, n-C_6H_{13}, n-C_7H_{15}, n- and sec.-C_8H_{17}. The characteristic ν of the C·I group and the deformation $\nu\nu$ of CH are discussed.   W. R. A.

Raman spectrum and vibrational frequencies of methylacetylene. B. L. CRAWFORD, jun. (J. Chem. Physics, 1939, 7, 140).—CMe:CH exhibits 12 Raman displacements; $\nu\nu$, intensities, polarisations, and assignments are given. It has C_{2v} symmetry and should have five degenerate and five non-degenerate fundamentals active in Raman effect. Vals. have been assigned to the ten fundamentals and low-temp. heat capacity measurements by the " hot-wire " method substantiate the assignment.   W. R. A.

Raman spectra and constitution of ozonides. Raman spectra of methyl citraconate and mesaconate and their ozonides. E. BRINER, D. FRANCK, and E. PERROTTET (Helv. Chim. Acta, 1939, 22, 224—228).—Data for Me citraconate agree with those of Kohlrausch. The absence of lines at 1830 cm.$^{-1}$ is evidence of a lactone structure for Me mesaconate. Additional frequencies in the region 1800—2700 cm.$^{-1}$ appear in the ozonides. The strong line characteristic of the double linking in the esters is still present in their ozonides.   C. R. H.

Polarisation of low-frequency lines of scattering in crystals. F. GROSS and M. VUKS (Acta Physicochim. U.R.S.S., 1938, 9, 209—214).—Measurements with Ph_2O and p-$C_6H_4Br_2$ show that the low-frequency Raman lines cannot be distinguished by the state of their polarisation from the ordinary vibrational lines in crystals, but the strong depolarisation of the continuous spectrum in the vicinity of the Rayleigh line in liquids is explained. A case of anomalous polarisation with $\rho \gg 1$ was observed with a crystal of p-$C_6H_4Br_2$.   O. J. W.

Light scattering in anisotropic liquids. I. Investigations in transmitted light. II. Depolarisation of scattered light. V. ZVETKOV (Acta Physicochim. U.R.S.S., 1938, 9, 111—129, 130—140).—Transmission measurements on liquid p-azoxyanisole (I) in magnetic fields up to 22,000 gauss have been made with particular reference to the influence of surface layers on the results. Both in longitudinal and in transverse fields max. transmissivity is attained at 2000 gauss and remains unaltered at higher field strengths. The effect of field strength on the degree of depolarisation has also been considered.

II. The state of polarisation of light scattered at 90° to the incident light by (I) and by acetoxybenzylideneazine and the influence of magnetic fields up to 20,000 gauss on the degree of polarisation have been studied. The scattering of light in strong magnetic fields cannot be interpreted by the theory of Ornstein and de Braaf.   W. R. A.

Scattering of light by anisotropic liquids. L. S. ORNSTEIN and W. DE BRAAF (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 105—106).—Results obtained by Zvetkov (cf. preceding abstract) on the effect of magnetic fields on the depolarisation of light scattered by anisotropic liquids can be explained by the " swarm " hypothesis.   J. A. K.

Theory of photodichroism. G. UNGAR (Compt. rend., 1939, 208, 337—338; cf. A., 1938, I, 528).   A. J. E. W.

Objective spectrophotometric determination of light scattered from clouds. R. TEUCHER (Physikal. Z., 1939, 40, 90—100).—The relation between the colour of light scattered by drops of a cloud (radius 5—12 μ.) and the size of the drops has been investigated experimentally. Spectra of the light scattered by the drops forming a cloud in a cloud chamber capable of producing a homogeneous cloud were photographed for different angles of scattering and for drops of various radii. The colour of the scattered light provided little information concerning the size of the drop.   A. J. M.

Chemiluminescent reactions of sulphur. E. SCHRÖER (Z. physikal. Chem., 1939, 42, B, 117—122).—Spectroscopic investigation of (i) the chemiluminescence observed when a mixture of S vapour and O_2 is cooled, (ii) the luminescence appearing when the mixture is subjected to a silent electric discharge or when O_3 is added, and (iii) the luminescence imparted to the H_2 flame by S or volatile S compounds, shows that the phenomenon is due to the S_2 mol. The excitation energy is supplied by recombination processes of the S.   W. R. A.

Phosphorescence of tetraphenylmethane and related substances.—See A., 1939, II, 150.

Chemoluminescence of benzoporphins.—See A., 1939, II, 128.

Fluorescence model of uranyl salts. N. F. MOERMAN and H. H. KRAAK (Rec. trav. chim., 1939, 58, 34—38).—The relation between the fluorescence and absorption spectra of UO_2 salts is explained on the basis of the variation of energy content of the $UO_2\cdot\cdot$ with the U—O interat. distance.   F. L. U.

Effect of moistening on the intensity of fluorescence of adsorbed dyes. F. BANDOW (Z. physikal. Chem., 1939, 42, B, 67—81).—The effect of moistening with various org. liquids on the intensity of different dyes adsorbed on inorg. bases has been investigated. The max. effect is obtained with low concns. of org. liquid.   W. R. A.

Luminescence of alkali halide crystals. M. N. PODASCHEVSKI and A. M. POLONSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 14—17).—Rock-salt gives a luminescence band with a max. of 4·98 e.v. at λ 248 mμ. Synthetic KCl has a max. of 4·4 e.v. at λ 220 mμ. The phosphorescence spectrum occurs near the luminescence spectrum. The effect of plastic deformation is discussed.   F. J. L.

Electrical and luminescent properties of phosphors under electron bombardment. W. B. NOTTINGHAM (J. Appl. Physics, 1939, 10, 73—83; cf. A., 1937, I, 283).—The properties of $Zn_3(PO_4)_2$, Ca tungstate, ZnS–CdS, and ZnS phosphors during elec-

tron bombardment in a cathode-ray tube operating at various potentials are recorded.   J. W. S.

Phosphorescence mechanism of samarium phosphorescent substances studied by the decay of their luminescence. V. LEVSCHIN and E. RICKMAN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 445—448).—The decay of intensity of the yellow and red lines of a CaS–Sm phosphor has been measured at 3 temp. The law of decay was hyperbolic, the decay const. being practically independent of temp. The initial intensity of luminescence was $\propto$ the square of the intensity of the exciting light. Excitation of these phosphors is therefore accompanied by complete separation of the electron from the phosphorescent centres, as in phosphors activated by heavy metals.   J. A. K.

Ionisation by vaporisation. G. LOVERA (Nuovo Cim., 1938, **15**, 377—383).—Experiments with various liquids (H_2O, EtOH, C_6H_6, C_6H_{14}) show that when the formation of ions occurs during the rapid evaporation of liquid drops, this is due to a mechanical agitation of the drops and not to the vaporisation process itself.   O. J. W.

Photoconductivity of metal films. T. C. WILSON (Physical Rev., 1939, [ii], **55**, 316—317).—Investigations on thin ribbons of Cu, Pt, and Pd, illuminated by X-rays, indicate either that the photoconductive effect in thin films of the metals sputtered on glass (cf. Bartlett, A., 1925, ii, 943) is a property of the bulk metal which can be caused only by ultraviolet radiation, or that the effect is restricted to films alone and is related to their structure, i.e., an external photo-electric current between discontinuous patches of the film.   N. M. B.

Actino-electric effects in tartaric acid crystals. J. J. BRADY and W. H. MOORE (Physical Rev., 1939, [ii], **55**, 308—311).—The crystals illuminated with light from a C arc show a flow of current when connected to a galvanometer without the aid of an impressed battery, the effect depending largely on the orientation of the crystal with respect to the light beam. A section of the crystal can be chosen showing a series of equipotential lines when its surface is examined with two probes while the crystal is illuminated. The measured currents are $\sim 10^{-12}$ amp. The effect is a linear function of light intensity for lower, but increasing more rapidly for higher, intensities, and is almost independent of temp. in the range 20° to −40°. The max. spectral response is at $\sim 10,500$ A.   N. M. B.

Sputtering of oxide-covered magnesium surfaces. R. W. DITCHBURN and K. I. ROULSTON (Proc. Camb. Phil. Soc., 1938, **34**, 620—624).—The low rate of sputtering of Mg in O_2 is due to the presence of an oxide film and not to charged particles being returned to the cathode by the electric field.   F. J. L.

Photo-electric current in alkali halide crystals with U centres under illumination with visible and ultra-violet light. V. P. PODDUBNI (Acta Physicochim. U.R.S.S., 1938, **9**, 703—711).—The possibility of a direct transition of an electron from the U to the F level with the formation of F from U

centres has been established for KCl. A photo-electric current is obtained by transferring electrons from the U level into the conductivity zone, with an intermediate state at the F level, during the simultaneous illumination of a crystal with U centres by narrow spectrum regions of ultra-violet or visible light.   C. R. H.

Inner photo-electric effect in potassium and sodium iodides by the action of ultra-violet radiation. V. P. PODDUBNI (Acta Physicochim. U.R.S.S., 1938, **9**, 712—716).—Spectral distribution curves for NaI and KI are reproduced. The possibility of electron transference from the lower zone of possible energy vals. to the upper zone has been demonstrated.   C. R. H.

Spectrum distribution of photo-electric currents in crystals of alkali halides with U centres. V. P. PODDUBNI (Acta Physicochim. U.R.S.S., 1938, **9**, 717—724).—The spectrum distribution of the primary and depolarisation photo-currents has been investigated for NaCl, NaBr, KCl, KBr, and KI with U centres. The presence of electrons at a level, U', somewhat higher than the U level has been demonstrated, and the energy differences between U and U' have been calc. for the five halides.   C. R. H.

Theory of solid rectifiers. D. BLOCHINTZEV and B. DAVIDOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 21—24).—Theoretical. Rectification takes place at the boundary of two semi-conductors of the same type, i.e., both having free electrons or positive " holes."   F. J. L.

Thermal theory of metallic photo-resistance. Q. MAJORANA (R.C. Atti Accad. Lincei, 1938, [vi], **28**, 177—182).—An expression is derived for the temp. variations in thin metallic films produced by illumination with periodically interrupted light (cf. A., 1939, I, 127).   O. J. W.

Contact between a metal and an insulator or semi-conductor. N. F. MOTT (Proc. Camb. Phil. Soc., 1938, **34**, 568—572).—Theoretical. The width of the electrical double layer formed when a metal and an insulator or semi-conductor are in contact is investigated. The theory of the Cu_2O rectifier is also discussed.   F. J. L.

Specific inductive capacity of diamonds by the method of mixtures. S. WHITEHEAD and W. HACKETT (Proc. Physical Soc., 1939, **51**, 173—190).—Diamonds in bulk gave a precision val. 5·66 at 27·8° and 800 cycles per sec. The mean val. was $5·7 \pm 1·5\%$ for the temp. range −65° to 85° and ν 300—3000, and $5·7 \pm 3·2\%$ for ν 50—5000; there was no change within 2% error up to ν 1·6 × 10⁶. Results agree with n on the basis of Maxwell's law and are consistent with the general relationships of sp. inductive capacity to at. no. and the periodic table.   N. M. B.

Behaviour of polar molecules in solid paraffin wax. R. W. SILLARS (Proc. Roy. Soc., 1938, A, **169**, 66—83).—The experiments were carried out on paraffin wax containing about 5% of various long-chain esters (Et, Bu, and dodecyl stearate and Bu, octyl, dodecyl, and cetyl palmitate). The material was placed between the plates of a test condenser

and the loss angle (energy absorption) measured at frequencies between 1 and 4000 kc. in the temp. range $-50°$ to $50°$. It is concluded that the whole ester mol. contributes to the time const. and that it behaves as a rigid structure. There is no simple relation between chain length and time const.

G. D. P.

Influence of distortion through non-linear rectification on the measurement of dielectric constants by the heterodyne method. S. R. KHASTGIR and K. SIRAJUDDIN (Z. Physik, 1939, **111**, 475—476).—The statement of Prasad and Verma (A., 1936, 666; 1938, I, 12), that ϵ for an electron containing space $\propto$ applied high-frequency potential, is not confirmed, and the apparent result is ascribed to distortion in the receiver through the use of too high a signal voltage in one component of the beat note.

L. G. G.

Relation between dielectric constants and internal pressures of non-polar liquids. D. I. COOMBER (Trans. Faraday Soc., 1939, **35**, 304—307).— The dielectric consts. (ϵ) of several non-polar liquids, when plotted against the internal pressures (P_i) calc. as the a/V^2 term of van der Waals' equation, lie approx. on a straight line passing through the point $\epsilon = 1$, $P_i = 0$. Possible reasons for slight departures from the linear relationship are discussed.

J. W. S.

Dispersion and absorption of short electric waves and molecular structure. E. KEUTNER and G. POTAPENKO (Physikal. Z., 1939, **40**, 100—104). —The dispersion and absorption of electric waves λ 18—130 cm. in MeOH, EtOH, Pr^{a}OH, Bu^{a}OH, and glycerol have been investigated. Taking into account the effect of neighbouring mols. it is found that the radius of the rotating member for the four alcohol mols. is the same. This rotating part is shown to be the OH group. It is the rotation of this group and not that of the whole mol. that is responsible for the dispersion and absorption of electric waves.

A. J. M.

Dipole moments of some nitronaphthylamines. V. G. VASSILIEV and J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1938, **9**, 203—204).—The vals. for 1 : 2-, 2 : 1 , and 1 : 5-$NO_2 \cdot C_{10}H_6 \cdot NH_2$ are given as 4·47, 4·89, and 5·22 D., respectively.   W. R. A.

Preparation and dipole moments of hetero-cyclic five-membered rings with one hetero-cyclic atom. H. DE VRIES ROBLES (Rec. trav. chim., 1939, **58**, 111—124).—The measurements were made in C_6H_6 solution at $20°$. Data are recorded for furan, di- and tetra-hydrofuran, thiophen, seleno-phen, and their H_4-derivatives, pyrrole, pyrroline, and pyrrolidine. A modification of Hedestrand's method of calculation is used.   F. L. U.

Electric polarisation of flexible molecules. N. R. DAVIDSON and L. E. SUTTON (J.C.S., 1939, 347). —An expression for the mean polarisation of a flexible mol. is given.   W. R. A.

Change of volume of the elements in the act of fusion. II. L. LOSANA (Gazzetta, 1938, **68**, 836— 843; cf. A., 1936, 21).—The % increase in vol. in passing from the solid to the liquid state is 4·17, 4·99,

and 5·195 for Cu, Ag, and Au, respectively. The effect of traces of other metals and impurities on the vol. change has been studied for Cu and Ag.

O. J. W.

Distant diffraction. J. SAVORNIN (Ann. Physique, 1939, [x], **11**, 129—255).—A detailed account of work already noted (cf. A., 1937, I, 503).

W. R. A.

Theory of optical activity. J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 139).—Polemical. The term $g^{(o)}$ (cf. A., 1937, I, 397) cannot be neglected in computing the rotatory power of $sec.$-BuOH as assumed by Gorin *et al.* (cf. A., 1939, I, 61) since it is a major factor in the simplified formula of Born.

W. R. A.

Structure of some optically active salts and their racemates. J. TER BERG (Rec. trav. chim., 1939, **58**, 93—98).—X-Ray study of compounds of the type $[M(en)_3]X_3,nH_2O$ (M = Co, Cr, Rh; X = Cl, Br) discloses a structural difference between crystals of the optically active salts and the racem-ates; symmetry elements involving the super-position of d- and l-ions in the latter are necessarily absent in the former. Both contain 4 mols. in the unit cell, dimensions of which are given. The active salts have space-group D_4^3 or D_4^7, and the racemic D_{3d}^4. In $[Co(en)_3]Br_3,nH_2O$ n is 1, not 2 as stated in the literature.   F. L. U.

Rotatory [magnetic] dispersion of deuterium oxide in the ultra-violet. A. HAGENBACH (Helv. Phys. Acta, 1936, **9**, 582—586; Chem. Zentr., 1937, i, 283).—Data for 99·6% D_2O are given. The mag-netic rotation is $\sim 4\% <$ that for H_2O, the difference increasing slightly with decreasing λ.

A. J. E. W.

Mobile rings produced in anisotropic drops of the nematic phase by the addition of an optically active substance. P. GAUBERT (Compt. rend., 1939, **208**, 43—45).—Extending previous work (A., 1939, I, 61), the effect of traces of various optically active compounds on the production of mobile rings in anisotropic drops of p-azoxyanisole has been studied. This action can be used to determine not only whether a given substance is optically active, but also the sign of its rotation.   W. R. A.

Space configuration of nitrogen in the 3-covalent state. B. K. SINGH (Current Sci., 1939, **8**, 13).—As the doubly linked valencies of N in an oxime grouping are not coplanar with the singly linked one, reduction of the oxime will give an amine in which the 3 valencies of N are also not coplanar.   W. R. A.

Use of monolayer measurements for deter-mining structures in aqueous media. Ester and triazo-group. A. E. ALEXANDER (J.C.S., 1939, 177—181).—The structure of org. mols. determined by usual methods applicable to the solid or gaseous states, or to solutions in non-polar solvents, may be different from the structure in aq. solution. From force-area and potential–area measurements on mono-layers of long-chain esters and of α-triazopalmitic acid (I) it is concluded that both the ester and the N_3 group, normally existing in a resonating state, lose this resonance on immersion in H_2O. The ester is-

present as $R-C\underset{O}{\overset{O}{<}}R'$ with practically free rotation around the C–O link. The measurements on (I) indicate that the N_3 group does not have a ring structure but the linear structure $^-N\leftarrow N\equiv N$.

W. R. A.

Structure of benzene. C. K. INGOLD (Proc. Roy. Soc., 1938, **A**, **169**, 148—173).—The Bakerian lecture. An account of modern views of the structure of the C_6H_6 mol. The application of the study of Raman and infra-red spectra to determine the modes of vibration of the mol. is described. G. D. P.

Dissociation schemes of diatomic hydrides and deuterides. L. GERÖ and R. SCHMID (Z. Physik, 1939, **111**, 588—595).—Theoretical.

L. G. G.

Critical potentials of carbon monoxide. J. SAVARD and M. DE HEMPTINNE (J. Phys. Radium, 1939, [vii], **10**, 30—31).—A detailed account of work already noted (cf. A., 1938, I, 296). W. R. A.

Phototropy and photochemical isomerism from the magnetic standpoint. S. S. BHATNAGAR, P. L. KAPUR and M. S. HASHMI (J. Indian Chem. Soc., 1938, **15**, 573—582).—χ is recorded for a no. of compounds before and after exposure to light. A fall in χ for CHPh:CH·CH:C(CO$_2$H)$_2$ corresponds with its dimerisation, which is also considered to be the cause of the fall in the case of CSCl$_2$ (cf. Schönberg, A., 1936, 437). Maleic acid does not show any measurable change. o-NO$_2$·C$_6$H$_4$·CHO shows a preliminary rise followed by a fall corresponding with the successive formation of o-NO·C$_6$H$_4$·CO$_2$H and its dimeride, confirmed by mol. wt. The colour change exhibited by a no. of anils and hydrazones on exposure to light is not accompanied by a change in χ and is attributed to a change in aggregation (cf. Senier and Shepeard, J.C.S., 1909, **95**, 1943). F. R. G.

Association through hydrogen. W. H. RODE-BUSH and A. M. BUSWELL (J. Physical Chem., 1939, **43**, 219—230).—The mechanism of H bond formation is discussed. C. R. H.

Rotation of molecules and ionic groups in crystals. A. EUCKEN (Z. Elektrochem., 1939, **45**, 126—150).—All available data on the subject are reviewed. A discussion, to which the author replies, and a bibliography of 115 references are appended.

C. R. H.

Characterisation of simple and carcinogenic aromatic hydrocarbons through the density distribution of certain valency electrons. (*B*-electrons.) II. O. SCHMIDT (Z. physikal. Chem., 1939, **42**, 83—110).—The density distribution of B-electrons (cf. A., 1938, I, 298) has been used to characterise C_6H_6 and substituted benzenoid derivatives, and carcinogenic derivatives of anthracene, phenanthrene, and fluorene. W. R. A.

Theory of liquid crystals. L. S. ORNSTEIN (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 1046—1048).—The limitations of the equation describing the phenomena in the surface layer of liquid crystals (Z. Krist., 1931, **79**, 112) are discussed.

W. R. A.

Electrostatic interaction of molecules. L. ONSAGER (J. Physical Chem., 1939, **43**, 189—196).—Theoretical. The lower limit for the electrical energy of an assembly of mols. is discussed with reference to various types of ionic lattice. C. R. H.

Anisotropic liquids. W. KAST (Z. Elektrochem., 1939, **45**, 184—202).—Data on and theories of anisotropy are reviewed. C. R. H.

Theory of liquids. N. F. MOTT and R. W. GURNEY (Trans. Faraday Soc., 1939, **35**, 364—368).—By extension of the theory of Lennard-Jones and Devonshire (A., 1938, I, 130) an expression is derived for the partition function for a liquid. A tentative theory of melting is also suggested. J. W. S.

Electrical-optical constants in polar liquids. N. DALLAPORTA (Nuovo Cim., 1938, **15**, 384—396).—Theoretical. Formulæ are derived for the mol. polarisation, mol. refraction, and Kerr const. of polar liquids, based on the assumption that the liquid mols. do not have free rotation and are arranged in small groups of quasicryst. structure. O. J. W.

Theory of liquids. R. FÜRTH, L. S. ORNSTEIN, and J. M. W. MILATZ (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 107—117).—A theory of the liquid state based on the assumption of the presence of " holes " in the quasi-cryst. structure has been developed. The theory leads to simple expressions relating the latent heat of fusion, γ, etc., from which vals. for the radii and concn. of the " holes " have been calc. for 13 elements. Calc. tensile strength of the solid, although $>$ usually observed experimentally, may be correct for the perfect solid. The viscosities of Sn, Pb, and Hg agreed with the theory, log η being a linear function of $1/T$. J. A. K.

Quasi-crystalline structure of liquids. P. DEBYE (Z. Elektrochem., 1939, **45**, 174—184).—Theories of liquid structure are briefly discussed.

C. R. H.

Thermal agitation waves in liquids. R. LUCAS (J. Phys. Radium, 1939, [vii], **10**, 60—74).—Mathematical. The method of thermal agitation used for solids (cf. B., 1938, 1) is extended to liquids. (Cf. A., 1939, 1, 67.) W. R. A.

Determination of parachors of inorganic salts in solutions. III. **Parachors of some salts of magnesium, strontium, and barium and the atomic parachor of the above elements and radium.** J. V. LAKHANI and R. P. DAROGA (J. Indian Chem. Soc., 1938, **15**, 604—607; cf. A., 1939, I, 129).—From the $[P]$ of MgCl$_2$,6H$_2$O, Mg(NO$_3$)$_2$, MgSO$_4$,7H$_2$O, SrCl$_2$,6H$_2$O, SrBr$_2$,6H$_2$O, Sr(NO$_3$)$_2$, BaCl$_2$, and Ba(NO$_3$)$_2$ determined by the solution method, the $[P]$ of Mg, Sr, and Ba are 57·7, 85, and 106. For these, Be, and Ca, log $[P] \propto$ log at. no., whence $[P]$ for Ra should be 140.

F. R. G.

Concrete as a protective material against high-voltage *X*-rays. G. SINGER, L. S. TAYLOR, and A. L. CHARLTON (J. Res. Nat. Bur. Stand., 1938, **21**, 783—794).—The absorption of X-rays by various kinds of concrete has been studied. Five X-ray excitation potentials from 200 to 400 kv. were used, the intensity transmitted by the samples being measured

by an ionisation chamber. The absorption was found to be dependent only on the density and not on the nature of the concrete mix, and the Pb equiv. increased for higher voltages. The thickness of concrete necessary for adequate protection can be calc. from the data.   J. A. K.

Patterson diagrams in crystal analysis. W. L. BRAGG (Nature, 1939, **143**, 73—74).—The " geometrical method " of interpretation of Patterson, Fourier synthesis, or vector maps (cf. A., 1939, I, 64) is essentially the same as that used previously by many investigators, and claims as to its novelty are exaggerated. The assumption that the insulin diagram can be explained by a certain concn. of scattering matter in a simple way at a few typical points in the mol. should be regarded with reserve.   L. S. T.

Vector maps and the cyclol hypothesis. J. D. BERNAL (Nature, 1939, **143**, 74—75; cf. preceding abstract).—The method of analysis of Patterson vector diagrams put forward with special reference to those of cryst. insulin (cf. A., 1939, I, 64) is substantially not new. The substitution of points for peaks in the vector map and the attempt to find a point system to which this map corresponds are untrustworthy. The scattering centre model derived from the cyclol hypothesis fails to account for the X-ray evidence for insulin, and the cyclol model leads to results incompatible with this evidence.   L. S. T.

Vector maps and heavy atoms in crystal analysis and the insulin structure. J. M. ROBERTSON (Nature, 1939, **143**, 75—76; cf. preceding abstracts).—59 relative measurements of amplitude cannot define a structure consisting of several thousand atoms. The suggestion that certain concns. of atoms in the mol. can be treated as point scattering sources is not a satisfactory approximation. Replacement of the Zn atoms in the insulin mol. by Hg might yield diagrams which would throw light on the structure of the mol.   L. S. T.

Temperature effect in Laue photographs. G. D. PRESTON (Nature, 1939, **143**, 76; cf. A., 1938, I, 611).—Photographs of Laue patterns of single crystals of Al show spots and streaks which are faintly marked at 20° and become intensified at 550°. Similar effects have been observed with NaCl (cf. A., 1938, I, 389), MgO, and the diamond. The effect is attributed to thermal vibrations of the lattice.   L. S. T.

Dependence of the lattice constant on wavelength. Lattice constants of LiF, NaF, As_2O_3, TlCl, and TlBr. M. STRAUMANIS, A. IEVIŅŠ, and K. KARLSONS (Z. physikal. Chem., 1939, **42**, **B**, 143—152).—Precision measurements on LiF, NaF, As_2O_3, TlCl, and TlBr, using the asymmetric method, indicate that no relation exists between the lattice consts. and the radiation used (Cu and Cr).   W. R. A.

Determination of crystallographic orientation of cubic single crystals. F. STÄBLEIN and H. SCHLECHTWEG (Tech. Mitt. Krupp, Forschungsber., 1938, No. 9, 157—160).—The method developed, using a Laue reflexion diagram, can be applied to statistical investigations on the orientation of single crystals of any material.   R. B. C.

X-Ray investigation of atomic vibrations in cadmium. G. W. BRINDLEY and P. RIDLEY (Proc. Physical Soc., 1939, **51**, 73—80).—Measurements of the intensities of X-ray reflexions from Cd powder at 86° and 293° K. were made, and abs. vals. of I_{86}/I_{293} are obtained from comparative measurements on a composite Cd–Al powder. Results are discussed in relation to theory on the effect of lattice vibrations in hexagonal metals on the intensities of X-ray reflexions. Lattice vibrations are greater parallel to the c axis than in the basal plane. Vals. are calc. for the mean at. displacements in different directions in the metal at 86° and 293° K. and results are also expressed in terms of characteristic temp., 107° parallel to the c axis, and 164·5° K. normal to the c axis. Results are compared with those for Zn and Mg, and with vals. obtained from sp. heat measurements.   N. M. B.

Characteristic temperature of magnesium oxide. G. W. BRINDLEY and P. RIDLEY (Proc. Physical Soc., 1939, **51**, 69—72).—The val. $715° \pm 44°$ K., derived from measurements of the intensity of X-ray reflexions at 86° and 293° K., shows fair agreement with the val. 743° K. found by Ribner (cf. A., 1938, I, 440).   N. M. B.

Crystallisation of water. I. W. ALTBERG (Acta Physicochim. U.R.S.S., 1938, **9**, 725—732).—The influences of rate of cooling and variations in external conditions on the shape and size of crystallisation nuclei and on the speed of crystallisation are discussed.   C. R. H.

Linear crystallisation velocity of water. A. T. LILIENTHAL (Wiadom. Inst. Met., 1934, **1**, No. 1, 23—26; Chem. Zentr., 1937, i, 286).—The velocity of crystallisation (v) along capillary U-tubes at —4·1° to —19·8° has been studied. The max. measured val. was 14·5 m. per min. in a 1·3—1·6-mm. tube at —19·8°, but v was higher in a 0·6-mm. tube. In general v increases with the degree of supercooling, and is largely dependent on the type of tube.   A. J. E. W.

Influence of surface phenomena on the temperature curve of the nuclei number for a supercooled organic liquid. G. L. MICHNEVITSCH and J. F. BROVKO (Acta Physicochim. U.R.S.S., 1938, **9**, 795—802).—During successive recrystallisations of betol, the nuclei no. at first decreases, remains stable for a while, next sharply increases, and finally becomes stable again. The temp. curve for the first region of stability is slightly displaced towards lower temp. during successive recrystallisations, whilst the left max. becomes more pronounced. The effects presuppose the presence of a continuous, non-uniform change in the distribution of the nuclei in the vol. of the betol which is connected with an enhancement of surface phenomena. This so-called " degeneration " is more pronounced at low temp.   C. R. H.

Crystallisation velocity of tin. H. JABŁOŃSKA (Wiadom. Inst. Met., 1934, **1**, No. 1, 11—13; Chem. Zentr., 1937, i, 289).—In the prep. of Sn single-crystals by Czochralski's method the crit. vals. of the rate of retraction from the melt (v) are 100 and 85 mm. per min. at 236° and 238°, respectively. The

effect of an increase in v on the crystal cross-section and the rate of crystallisation has been studied at these temp.　　　　A. J. E. W.

Crystallisation velocity of lead and its alloy with mercury. I. MAKOWSKA (Wiadom. Inst. Met., 1934, **1**, No. 1, 14—16; Chem. Zentr., 1937, i, 289). —Crit. rates of retraction (cf. preceding abstract) for single-crystal formation are : Pb, 45 and 170 mm. per min. at 359° and 329°; Pb–Hg alloy (5% Hg) 100 mm. per min. at 309°.　　　　A. J. E. W.

Crystallisation velocity of aluminium and gold. Z. BECKERÓWNA (Wiadom. Inst. Met., 1934, **1**, No. 1, 7—10; Chem. Zentr., 1937, i, 289).—99·5% Al can be supercooled 25°. Czochralski's method gives single- or poly-cryst. rods, according to the rate of retraction from the melt; the max. rate for single-crystals is 40 mm. per min. at 668°, the crystal being drawn out with a single-crystal fragment. Impurities reduce the rate of crystallisation. Dendritic Au single-crystals are obtained with a max. retraction rate of 24 mm. per min. at 1063°.　　　　A. J. E. W.

Structural characteristics of certain silver films. S. F. ESSIG (J. Appl. Physics, 1939, **10**, 61—72).—The structural characteristics of Ag films used as photo-cathode bases in television image analysers and other electronic devices are discussed. Films produced by thermal reduction of air-settled Ag_2O have a wide range of particle size (1—30 μ.), but particles <3 μ. are most numerous. On reduction at 700—800° a liquid phase develops, and the Ag film produced comprises a mosaic of Ag beads well separated from one another and adhering firmly to the mica substrate. Sputtered or evaporated films show a smaller and more uniform particle size (0·1—0·2 μ.). Translucent films, designed for rear illumination of the sensitised Ag surface, consist of a Ag mosaic superimposed on a relatively transparent electrically conducting film, preferably of Pt, which is protected from oxidation and alloying with the Ag by an intermediate film of SiO_2 or Al_2O_3.　　　　J. W. S.

Silver films on a mica crystal face. S. ESSIG (Physical Rev., 1939, [ii], **55**, 229).—The prep. of a Ag film by evaporation in vac., and agglomeration at 400°, on to a mica lamina is described. Photomicrographs show marked regular orientation of the Ag crystals by at. migration.　　　　N. M. B.

[Crystal] structure of the intermetallic compound $NaAu_2$. H. PERLITZ and E. ARUJA (Z. Krist., 1938, **100**, 157—166; cf. A., 1937, I, 447; Haucke, *ibid.*, 508).—From powder X-radiograms for cubic members of the Na–Au system, vals. of a are 7·7872±0·0002 A. for $NaAu_2$ at 18·4°, and 4·0700± 0·0005 A. for Au at 20°; corresponding vals. from the phase $Na_{14·5}Au_{85·5}$ are 7·771 and 4·050 A., respectively. Photometred intensities for $NaAu_2$ confirm its $MgCu_2$ structure. The Au-rich limit for the $NaAu_2$ phase occurs at 67·7 at.-% Au.　　　　I. McA.

Space lattice of aluminium boride, AlB_{13}. F. HALLA and R. WEIL (Naturwiss., 1939, **27**, 96).— AlB_{13} has a monoclinic unit cell with a 17·01, b 10·98, c 18·80 A.; β 110° 54′±6′; ρ_4^{18} 2·569; vol. of unit cell 3284·4 A.³; 446—448 atoms per cell, corresponding better with AlB_{13} than with AlB_{12}. The space-group is C_{2h}^6–$C2/c$.　　　　A. J. M.

Investigation of the $SiHCl_3$ molecule by X-rays. M. H. PIRENNE (Physikal. Z., 1939, **40**, 145—158).—The v.p. of pure $SiHCl_3$ from 30° to 90° is recorded. The X-ray interference patterns were obtained with $SiHCl_3$ at 4·5 atm. and 100°, the intensity being three times that at atm. pressure. Using Mo $K\alpha$-rays, normal diagrams were obtained with an exposure of 35 hr. The valency angle is calc. to be 111·5±1°. The Cl—Cl distance suffers a greater increase in passing from CCl_4 to $CHCl_3$ than from $SiCl_4$ to $SiHCl_3$.　　　　A. J. M.

Crystal structure of NH_4CdCl_3 and $RbCdCl_3$. C. H. MACGILLAVRY, H. NIJVELD, S. DIERDORP, and J. KARSTEN (Rec. trav. chim., 1939, **58**, 193—200).— NH_4CdCl_3 has a 9·00, b 14·90, c 3·96 A.; $RbCdCl_3$ has a 9·01, b 14·93, c 4·01 A. The unit cells contain 4 mols. Cd is surrounded by 6 Cl, and NH_4 or Rb by 9 Cl.　　　　E. S. H.

Electron-diffraction investigation of the molecular structures of cyanogen chloride and cyanogen bromide. J. Y. BEACH and A. TURKEVICH (J. Amer. Chem. Soc., 1939, **61**, 299—303).— Interat. distances (in A.) recorded are : ClCN, C—Cl 1·67±0·02, C—N 1·13±0·03; BrCN, C—Br 1·79± 0·02, C—N 1·13±0·04. The double linking character of the C–halogen linking is 24% in ClCN and 33% in BrCN.　　　　E. S. H.

Crystallography of potassium tetrathionate. G. TUNELL, H. E. MERWIN, and C. J. KSANDA (Amer. J. Sci., 1938, [v], **35**, A, 361—372).—$K_2S_4O_6$ has $a : b : c = 1·3885 : 1 : 1·2615$, β 104° 01′. X-Ray examination gives a_0 22·05, b_0 7·99, c_0 10·09 A. The unit cell contains 8 mols. Vals. of n for different $\lambda\lambda$ are recorded.　　　　E. S. H.

Crystal structure of iron enneacarbonyl. H. M. POWELL and R. V. G. EWENS (J.C.S., 1939, 286— 292).—By the action of light on $Fe(CO)_5$, $Fe_2(CO)_9$ was obtained as thin, yellow, hexagonal plates, optically uniaxial with double refraction, d 2·08, two mols. per unit cell, space-group $C6_3/m$. A complete list of parameters is given. There is a horizontal plane of symmetry through the mol. The two Fe atoms are equiv. in every respect, but C and O atoms fall into two groups chemically and crystallographically. The interat. distances and valency angles are recorded and discussed.　　　　W. R. A.

Structure and chemical constitution of some ferrocyanides. R. RIGAMONTI (Gazzetta, 1938, **68**, 803—809).—X-Ray measurements show that the compounds of the type $K_2M[Fe(CN)_6]$, with M = Cu, Fe, Co, Ni, have a cubic structure. The vals. of a are 10·0, 10·2, 10·1, 9·98 A., respectively. The compounds with M = Zn and Cd have a lower symmetry and are not isomorphous with the aforementioned compounds. $KFe[Fe(CN)_6]$ and $KAl[Fe(CN)_6]$ also have a cubic structure with a 10·2 and 9·78 A., respectively. The following compounds have a lower symmetry : $Ca_2[Fe(CN)_6]$, $Ba_2[Fe(CN)_6]$, $CaK_2[Fe(CN)_6]$, $BaK_2[Fe(CN)_6]$, $Pb_2[Fe(CN)_6]$, $CuCa[Fe(CN)_6]$, $CuBa[Fe(CN)_6]$, $CuSr[Fe(CN)_6]$,

and $CuMg[Fe(CN)_6]$, but no lattice data were obtainable.   O. J. W.

Unit cell and space group of β-glycine. C. J. KSANDA and G. TUNELL (Amer. J. Sci., 1938, [v], **35, A,** 173—178).—X-Ray investigations give a_0 5.07 ± 0.01, b_0 6.23 ± 0.01, c_0 5.37 ± 0.01 A., β $113° 27'$ $\pm 15'$. The space-group is $C_{2h}^2—P2_1/m$ or $C_2^2—P2_1$.   E. S. H.

X-Ray study of menthol. S. S. SIDHU (J. Appl. Physics, 1939, **10,** 83—84).—The stable α-form of menthol crystallises in the hexagonal form with a_0 11.82 ± 0.02 A., c_0/a_0 1.635. The unit cell contains 8 mols. and the $d_{calc.}$ is 0.885.   J. W. S.

Crystal structure and configuration of the isomeric azobenzenes. J. M. ROBERTSON (J.C.S., 1939, 232—236).—trans-Azobenzene crystallises in the monoclinic system, space-group C_{2h}^5 ($P2_1/a$), with four centrosymmetrical mols. in the unit cell. Two almost planar centrosymmetrical mols. contribute to the asymmetric unit. cis-Azobenzene crystals are orthorhombic, space-group D_{2h}^{14} ($Pbcn$), four mols. per unit cell, and have a dyad axis of symmetry. The structure and dimensions of both mols. are discussed.   W. R. A.

Mechanism of deformation of fibrous substances. VII. Net structure of swollen cellulose hydrate. P. H. HERMANS, O. KRATKY, and P. PLATZEK (Kolloid-Z., 1939, **86,** 245—254).—The results of X-ray diffraction investigations confirm the theory of net structure (cf. A., 1939, I, 141).   E. S. H.

Internal rotation in ethylene chlorobromide and ethylene bromide. J. Y. BEACH and A. TURKEVICH (J. Amer. Chem. Soc., 1939, **61,** 303—308).—Electron-diffraction investigations give the interat. distances : $C_2H_4Br_2$, C—Br 1.91 ± 0.02 A.; C_2H_4ClBr, C—Cl 1.75 ± 0.02, C—Br 1.90 ± 0.02 A. The observed potential barriers can be calc. by taking into account the electrostatic interactions and the exchange repulsions of the two ends of the mols. The exchange repulsions are calc. by the method used for $C_2H_4Cl_2$ (A., 1938, I, 604).   E. S. H.

Method of radial distribution applied to the interpretation of the diffraction of electrons by the molecules of gases. C. DEGARD (Bull. Soc. chim. Belg., 1938, **47,** 770—808).—Mathematical.   F. J. G.

Ferromagnetic transformations. Problem of the Curie temperature. W. GERLACH (Z. Elektrochem., 1939, **45,** 151—170).—A general review, followed by discussion and a classified bibliography, of investigations on ferromagnetism.   C. R. H.

Initial susceptibility in presence of transverse magnetisation. A. PERRIER and H. FAVEZ (Helv. Phys. Acta, 1936, **9,** 563—573 ; Chem. Zentr., 1937, i, 293 ; cf. A., 1935, 435).—Determinations of χ for a very soft steel, using low H with transverse magnetisation, are described and discussed.   A. J. E. W.

Influence of heat-treatment in a magnetic field on the distribution of the spontaneous regions of a ferro-magnetic monocrystals. J. S. SCHUR (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21,** 18—20).—A coarse-grained polycrystal of Si–Fe

(3.5% Si) was polished and then heated to 800° and annealed in a magnetic field, the surface being coated with a fine suspension of Fe in EtOH. The Fe powder formed " powder figures " or " Bitter figures " in the form of bands which usually followed the direction of the magnetic field in the specimen during magnetisation. The effect of annealing in a magnetic field is dependent on the orientation of a monocrystal and also alters the shape of its curve of magnetic anisotropy.   F. J. L.

Shape of the domains in ferromagnetics. E. H. KENNARD (Physical Rev., 1939, [ii], **55,** 312—314).—Mathematical.   N. M. B.

Magnetic anisotropy of iron, nickel, and cobalt. K. HONDA and T. HIRONE (Z. Physik, 1939, **111,** 477—483).—Magnetic anisotropy of single ferromagnetic crystals is discussed from a new viewpoint. Calc. vals. of the const. of magnetic anisotropy for Fe and Ni agree with experiment, but for Co there is a small discrepancy ; this is lessened by taking the hysteresis of magnetisation and demagnetisation into account.   H. C. G.

Change of magnetic properties of the single crystal of nickel due to temperature. T. OKAMURA and T. HIRONE (Physical Rev., 1939, [ii], **55,** 102).—Using a Ni single crystal in the form of a hollow parallelogram (cf. Williams, A., 1938, I, 18), the magnetisation curve and hysteresis curve were obtained from the b.p. of N_2 to the Curie point of Ni. Residual magnetism, coercive force, and hysteresis loss show max. at 100°. At the lowest temp. the coercive force falls to a min. of 0.7 oersted. The magnetic properties of the single crystal are greatly affected by temp.   N. M. B.

Dielectric behaviour of Rochelle salt and related substances. P. SCHERRER (Z. Elektrochem., 1939, **45,** 171—174).—The dielectric, piezo- and pyro-electric, optical, and thermal properties of Rochelle salt, KH_2PO_4, and KH_2AsO_4 are reviewed, and explanations for their behaviour are discussed.   C. R. H.

Magnetic after-effect and chemical constitution. J. L. SNOEK (Physica, 1939, **6,** 161—170 ; cf. A., 1938, I, 506).—Magnetic viscosity and reversible decrease of permeability with time are absent in pure Fe, and can be produced by 0.01% of C or N. The effect is explained by diffusion of C or N atoms under the influence of magnetostrictive strain.   L. J. J.

Optical properties of transparent crystals. P. BURGATTI (Nuovo Cim., 1938, **15,** 439—461).—Mathematical.   O. J. W.

Dispersion of light in a quartz crystal. K. S. VULFSON and M. I. LOMBERT (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21,** 25—27).—The intensity of dispersed light in quartz crystals is measured between 0° and 700° K. for different directions in the crystals. The relation between the intensity of the dispersed light and the electric, optic, and crystallographic axes is discussed.   F. J. L.

Spectral reflectivity of rhodium. W. W. COBLENTZ and R. STAIR (J. Res. Nat. Bur. Stand., 1939, **22,** 93—95).—The spectral reflectivity of Rh mirrors

electrolytically deposited on plate glass and on polished Cu has been investigated in the ultra-violet, the visible, and the infra-red. The reflectivity diminishes rapidly with λ. In the visible the reflectivity of Rh is slightly > that of Cr.
W. R. A.

Elastic deformation of Rochelle salt. H. HINZ (Z. Physik, 1939, 111, 617—632).—The nine possible elastic consts. of Rochelle salt are determined by a static method involving compression of the crystal. Results are in agreement with those obtained from dynamic methods. The deformation in an electric field is $\propto T$.
L. G. G.

Elastic constants of transparent isotropic solids by a new method. E. HIEDEMANN (Z. Physik, 1939, 111, 558; cf. A., 1938, I, 504).— Polemical against Hoesch.
H. C. G.

Method for measuring elastic constants and the phase velocity of transverse and longitudinal waves. F. KHOL (Z. Physik, 1939, 111, 450—453).—Data are calc. from measurements of the frequencies of radial and torsional vibration of tourmaline plates.
H. C. G.

Elasticity measurements on alkali metal single crystals at low temperatures. O. BENDER (Ann. Physik, 1939, [v], 34, 359—376).—The prep. of single crystal rods of K and Na is described. Apparatus for the simultaneous measurement by a static method of torsion and bending moduli at low temp. is described. The principal elastic moduli of single-crystal K and Na and of polycryst. Li are calc. from such measurements. Vals. agree with the theory of Fuchs (A., 1936, 672). Elastic consts. for quasi-isotropic K and Na crystals are calc. by the theory of Bruggeman, and those of Li found by extrapolation from experimental data. Vals. disagree with the quantum jump theory of Simon (A., 1935, 574). Vals. for the elastic consts. of Na disagree with those of Quimby and Siegel (A., 1938, I, 564).
O. D. S.

Discussion on plastic flow in metals. W. L. BRAGG and others (Proc. Roy. Soc., 1938, A, 168, 302—317).
G. D. P.

Thermodynamic theory of phase transformations. C. FINBAK (Tids. Kjemi, 1938, 19, 1—5).— Mathematical treatment of a one-component system.
M. H. M. A.

Polymeric forms of silver cyanide. O. SCHMITZ-DUMONT (Ber., 1939, 72, [B], 298—299).—The supposed monomeric and dimeric forms of AgCN give identical X-ray diagrams and have the same mol. wt. in C_5H_5N.
F. J. G.

Comprehensive fundamental electrical formula. R. APPLEYARD (Nature, 1938, 142, 1163; cf. A., 1939, I, 63).
L. S. T.

Carbon and graphite. (A) Variation with temperature of electrical resistance between 0° and 900°. L. J. COLLIER, W. S. STILES, and W. G. A. TAYLOR. (B) Thermal and electrical conductivities to high temperatures. R. W. POWELL and F. H. SCHOFIELD (Proc. Physical Soc.; 1939, 51, 147—152, 153—172).—(A) Data in the temp. range 0—900° for the variation with temp. of the electrical resistance of specimens of amorphous C and Acheson graphite are tabulated and plotted and an expression is found for the results.

(B) A method for the simultaneous determination of the thermal conductivity K and the electrical conductivity σ of rods of C and Acheson graphite electrically heated in vac. is described, and results up to temp. of ~ 2000° and 2700°, respectively, are reported. There is evidence of the graphitisation of C at the highest temp. At normal temp. the Lorenz functions $K\sigma/T$ of C and graphite are respectively about 17 and 200 times as great as the normal val. for metals, but decrease rapidly with rise of temp., and at 1700° are ~4 times as great as those of metals.
N. M. B.

Effect of a magnetic field on the electrical resistance of gold and silver at temperatures between 1° and 20° K. J. W. STOUT and R. E. BARIEAU (J. Amer. Chem. Soc., 1939, 61, 238—241). —Electrical resistances of Au and Ag wires have been measured at 1·5—20° K. in magnetic fields of 0—8000 gauss. At the lowest temp. the resistance and magnetic coeff. of Ag are independent of temp., but at higher temp. the resistance increases and the magnetic coeff. of resistance decreases. Au wire has min. resistance and max. magnetic coeff. of resistance at 7·7° K. Extrapolation of the results indicates that at 1° K. the magnetic coeff. would become 0, and at lower temp. would be negative.
E. S. H.

Thin metallic films. VII. Electrical conductivity. IV. E. PERUCCA (Nuovo Cim., 1938, 15, 365—376; cf. A., 1935, 20).—Using Au films obtained by cathodic sputtering, measurements have been made of the surface layer conductivity at 55—250° for varying thicknesses of film up to 1000 A. The thickness of film at which measurable conductivity commences increases with temp. The influence of the granular nature of the surface is discussed.
O. J. W.

Electrical resistance of a metal at low temperatures and Matthiessen's rule. G. P. DUBE (Proc. Camb. Phil. Soc., 1938, 34, 559—567).— Theoretical.
F. J. L.

Superconductivity and amorphous modifications of metals. J. KRAMER (Z. Physik, 1939, 111, 423—436).—Parallel variations of the limiting temp. for superconductivity and of the temp. of transition metallic → amorphous modification, with pressure, under the influence of a magnetic field, and with at. no. are discussed in relation to the at. vol.-at. no. curves and the ionisation energy of atoms in cryst. metals.
H. C. G.

Equilibrium between spin and lattice. H. B. G. CASIMIR (Physica, 1939, 6, 156—160).—The author's thermodynamical theory (cf. A., 1938, I, 391) is extended to the case in which the lattice temp., as well as the spin temp., is variable. In adiabatic demagnetisation the lattice will follow the spins, and the rate of rise of temp. will increase with the sp. heat of the lattice.
L. J. J.

Relation between magnetic susceptibility and interatomic distances in hydrogenised palladium. A. MICHEL and (MLLE.) M. GALLISSOT (Compt. rend.,

1939, **208**, 434—436).—The cryst. parameters, χ, resistance, and hardness of Pd_4H (α-phase) and PdH (β-phase, prepared at $-40°$) remain const. after removal of the H at room temp.; the vals. for pure Pd recur after annealing. The variation in these factors appears to be due to interat. distance changes, and not to introduction of H.   A. J. E. W.

Exchange force transitions in paramagnetic compounds. C. F. SQUIRE (J. Chem. Physics, 1939, **7**, 139—140).—The paramagnetic susceptibility of MnO, measured between $14°$ and $298°$ K., becomes almost zero below $116°$ K. This temp. is coincident with that at which a " hump " occurs in the sp. heat curve of MnO. This suggests that the electron spins at high temp. are coupled at the low temp. giving rise to an exchange force which draws the atoms together. For MnX ($X =$ Te, Se, S, O) the higher is the at. no. of X, the higher is the transition temp., since more energy is required to raise the crystal into the high-energy state.   W. R. A.

Paramagnetic dispersion. P. TEUNISSEN and C. J. GORTER (Physica, 1939, **6**, 145—155; cf. A., 1937, I, 452; 1938, I, 128, 505; 1939, I, 66).—Redetermination of measurements at $64°$ K. with frequencies between 0.2 and 5.0×10^6 and field strengths of 800—3200 oersted shows that with Cr K alum (I) the dispersion curves at this temp. differ from those at $77°$ K. only by a shift towards lower v by a factor 3.15. Corresponding measurements are recorded for Fe NH_4 alum (II). The shapes of the dispersion curves at $64°$ K. and liquid He temp. are similar. Replacement of 9% and 40% of the Cr in (I) by Al shifts the curves only slightly towards higher v, whilst substitution of D_2O for H_2O in (II) has no effect at $64°$ K., but at higher temp. displaces the curves towards lower v. Paramagnetic dispersion has been observed with a no. of hydrated Cr^{+++}, Mn^{++} and Fe^{+++} salts, but not with hydrated Ti^{+++}, V^{+++}, Fe^{++}, Co^{++}, Ni^{++}, or Cu^{++} salts, in agreement with the theory of Kronig (A., 1939, I, 132) and Van Vleck.   L. J. J.

Anomalies in the magnetism of several anhydrous salts of the iron group. W. J. DE HAAS and B. H. SCHULTZ (J. Phys. Radium, 1939, [vii], **10**, 7—9).—The magnetic susceptibility χ_M of $CoCl_2$ has been measured for a wide range of field strength H at low temp. At $20°$ K. χ_M is const. for $H < 800$ gauss; for $H > 800$ gauss it increases and attains another const. val. for $H > 20,000$ gauss, so that even at 29,000 gauss and $14°$ K. the substance is not saturated. At liquid H_2 temp. very weak " remanences " are found, whilst cooling the substance in a magnetic field gives a very strong " remanence " of magnetism.   W. R. A.

Ferromagnetism of semiconductors. S. MIYAHARA (Physical Rev., 1939, [ii], **55**, 105).—A theory in which ferromagnetism vanishes at very low temp. is outlined.   N. M. B.

Suitability of a diamagnetic crystal for the measurement of magnetic fields. R. G. STANSFIELD (Proc. Camb. Phil. Soc., 1938, **34**, 625—633).—The diamagnetic crystals of calcite and $NaNO_3$ can be used for measuring strong fields to 1 in 1000.

Their magnetic anistropy does not alter between room temp. and liquid N_2 temp., but in small fields the accuracy is limited by ferromagnetic contamination.   F. J. L.

Metamagnetism. J. BECQUEREL and J. VAN DEN HANDEL (J. Phys. Radium, 1939, [vii], **10**, 10—13).—Measurements have been made of the magnetic rotatory power of " mésitite " (a mineral containing the carbonates of Fe and Al); at very low temp. hysteresis effects and " remanence " magnetism, characteristic of ferromagnetic substances, are shown. Unlike the ferromagnetic substances, however, even at fields of $>30,000$ gauss, and at $1.5°$ K., no sign of attainment of saturation is evident and the rotation increases very rapidly with the intensity of the field. Further, the hysteresis effects are not shown if the field is several thousand gauss. The possibility of the phenomenon, for which the name " metamagnetism " is proposed, as a new aspect of ferromagnetism is discussed.   W. R. A.

Thermomagnetic properties of cubic ferric oxide. G. CHAUDRON and A. MICHEL (Compt. rend., 1939, **208**, 90—92).—The work of Forrer (A., 1939, I, 37) is criticised, and evidence is adduced that Fe_2O_3 occurs only in the known cubic and rhombohedral forms.   A. J. E. W.

Sound absorption of snow. G. W. C. KAYE and E. J. EVANS (Nature, 1939, **143**, 80).—Absorption coeffs. of frequencies from 125 to 4000 cycles per sec. show that freshly fallen snow is a high absorbent of sound, its effectiveness being equalled by few known materials of corresponding thickness.   L. S. T.

Velocity of sound. R. C. COLWELL, A. W. FRIEND, and D. A. McGRAW (J. Franklin Inst., 1939, **227**, 251—255).—Apparatus for determining the velocity of sound by an oscillograph method (A., 1939, I, 14) has been improved. Determinations were made at temp. between $2.5°$ and $29.6°$, and the slope of the velocity–temp. curve was found to be 0.595 m. per sec. per $°$ c. An alternative method gave 331.12 m. per sec. for the velocity at $0°$, $\lambda\lambda$ being measured at 440, 880, 1000, 1320, and 1760 cycles per sec.   A. J. M.

Dissipative acoustic reflexion coefficients in gases by ultrasonic interferometry. R. S. ALLEMAN (Physical Rev., 1939, [ii], **55**, 87—93; cf. Hubbard, *ibid.*, 1931, [ii], **38**, 1011; Herzfeld, A., 1938, I, 391).—A modification of the theory of the acoustic resonator interferometer so as to include dissipative losses by emission and reflexion at the source as well as losses by reflexion at the reflector is given. An analysis of available and also new data for CO_2, air, and He shows good agreement with theory. The requirements for securing such data, including the plane parallelism of source and reflector and modes of vibration of the source, were studied by optical, electrical, and acoustical methods.   N. M. B.

Application of Töpler's method to the measurement of supersonic absorption in air. F. A. KOROLEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 545—546).—Data are recorded for 930—3530 khz., giving $\alpha\lambda^2 = 2.1 \times 10^{-4}$ cm. ($\alpha =$ absorption coeff. in cm.$^{-1}$).   L. J. J.

Absorption of supersonic waves in air and argon. A. T. DADAJAN and E. J. PUMPER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 539—542).—Absorption coeffs. determined in both air and A at varying pressure give vals. > those calc. from η and thermal conductivity data. The discrepancy in the case of air can therefore not be explained by Kneser's relaxation hypothesis (A., 1933, 343).
L. J. J.

Supersonic velocity in gases and vapours. II. Supersonic satellites in vapours. III. Volume resonance in a supersonic interferometer. S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 455—465, 477—487; cf. A., 1938, I, 607).—II. Owing to diffraction effects, narrow tubes must be used for velocity measurements with the Pierce interferometer. Vals. are given for a no. of gases and vapours in a 1-cm. tube, for 49·4 khz.

III. In narrow tubes of varying diameter, especially when closed with apertures, the position of resonance peaks depends on a vol. resonance effect, such that the vol. contained between consecutive points of resonance is const., and $\propto$ the inverse square of the frequency.
L. J. J.

Supersonic velocity in gases and vapours. V. Specific heats of vapours of acetone, benzene, cyclohexane, n-hexane, methyl, ethyl, and n-propyl ethers. S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 19—37).—The velocity of supersonic waves of various frequencies has been measured in vapours of the compounds named at 97° and 134°, using apparatus previously described (cf. A., 1938, I, 607). Although in some cases absorption increased at the higher frequencies, no dispersion of velocity was found. The results have been used to calculate the sp. heats, which are compared with those calc. from spectroscopic data by a semi-empirical formula.
J. A. K.

Theory of diffraction of light by ultrasonic waves. R. EXTERMANN and G. WANNIER (Helv. Phys. Acta, 1936, **9**, 520—532; Chem. Zentr., 1937, i, 276).—An expression for the intensity of diffracted light in terms of the width of the ultrasonic beam, the $\lambda\lambda$, and the angle between the directions of propagation is derived.
A. J. E. W.

Dispersion of ultrasonic waves in castor oil. L. ZACHOVAL (Compt. rend., 1939, **208**, 265—266).—Dispersion due to the high η has been observed with frequencies of 2000 and 6000 kc. per sec., at ~18°.
A. J. E. W.

Adiabatic demagnetisation starting from temperatures obtained with solid hydrogen. N. KÜRTI, P. LAÎNÉ, and F. SIMON (Compt. rend., 1939, **208**, 173—175).—The temp. of $FcNH_4(SO_4)_2,12H_2O$ has been reduced from 8·5° K. to 0·36° and 0·15° K. by adiabatic demagnetisation, using fields of 29 and 42 kilogauss, respectively.
A. J. E. W.

Properties of purified normal heptane and isooctane (ββδ-trimethylpentane). D. B. BROOKS (J. Res. Nat. Bur. Stand., 1938, **21**, 847—852).—Highly purified samples of n-heptane and "isooctane" have b.p. 98·422° and 99·234°, f.p. —90·576° and —107·311°, respectively.
A. K

Structure and melting of long-chain ketones. J. W. H. OLDHAM and A. R. UBBELOHDE (Trans. Faraday Soc., 1939, **35**, 328—337).—Results previously recorded (A., 1938, I, 444) are extended and discussed. The f.p. of a long-chain ketone is higher when the CO group is near one end of the chain or symmetrically in the middle. The latent heat of fusion and entropy-increase on fusion suggest no fundamental change of structure when the position of the dipole is varied. X-Ray examination shows that the crystal structure is very similar to that of the corresponding paraffins, and differences in f.p. are attributable only to the influence of layers of dipoles. It is suggested that the activation energy of fusion is supplied by the torsional oscillations of the C chains in the crystal.
J. W. S.

Specific heats and fluctuations of molecular field. L. NÉEL (Compt. rend., 1939, **208**, 177—179).—Terms in the sp. heat (c) equation for Ni are considered. The spin interaction term for temp. above the Curie point is evaluated from magnetic data, and calc. vals. of c in agreement with experimental data are obtained.
A. J. E. W.

Specific heats at low temperatures of crystalline ortho-, meta-, and di-silicates of sodium. K. K. KELLY (J. Amer. Chem. Soc., 1939, **61**, 471—473).—Sp. heats for the range 52·5—298·1° K. are recorded. The entropies at 298·1° K. are 46·8±0·6, 27·2±0·3, and 39·4±0·6, respectively. Na_2O has approx. entropy 17 and free energy of formation —91,000 g.-cal.
E. S. H.

Relation between specific heat and temperature for nitrobenzene. J. MAZUR (Nature, 1939, **143**, 28).—For specially-purified $PhNO_2$ between 5° and 20°, $c_p = 0.33830 + 0.0005560$.
L. S. T.

Heat capacity of ethylene in the critical range. D. B. PALL and O. MAASS (Canad. J. Res., 1938, **16**, B, 449—452).—Work previously reported (A., 1938, I, 565) has been repeated using improved apparatus, and the former findings are confirmed. The difference in heat capacity resulting from different thermal history is shown to be definitely outside the limit of experimental error.
F. J. G.

Liquefaction of helium by means of the Joule–Thomson effect. J. L. ZELMANOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 537—538; cf. A., 1938, I, 536).—Enthalpies of He at 4·2° K. and 1—30 atm. are calc. from Keesom's data, giving vals. of the limiting liquefaction coeff. in agreement with experiment.
L. J. J.

Active substances. XXXVI. Surface and heat content of strongly-heated cupric oxides. R. FRICKE and R. DACHS (Ber., 1939, **72**, [B], 405—406; cf. A., 1938, I, 529).—Further ignition at 800° and 900° of CuO which has been heated to 600° causes no appreciable decrease in heat content. The results of Joannis (A., 1886, 666) are incorrect.
F. J. G.

Spontaneous crystallisation and rate of crystallisation of water and heavy water. J. TIMMERMANS, J. DE ROOSTER, and J. MICHEL (Compt. rend., 1939, **208**, 282—283; cf. A., 1937, I, 446).—The possible degree of supercooling is considerably

reduced by agitation, and increased by previous heating. The time of supercooling is small below $-30°$, and increases rapidly above $-10°$. The rates of crystallisation, which are identical for H_2O and 51 and 95% D_2O, are 217 and 337 mm. per min. for 6° and 8° of supercooling, respectively.

A. J. E. W.

Fusion of graphite under high pressures of argon, up to 4000 kg. per sq. cm. J. BASSET (Compt. rend., 1939, 208, 267—269).—The crit. pressure and temp. at the triple point are 170 kg. per sq. cm. and 4000° K. The m.p. probably falls with increasing pressure. Graphite previously fused at 4000 kg. per sq. cm. has d 2·25.   A. J. E. W.

Intermolecular forces in liquid systems. I. **Physical properties of the alkyl carbonates.** S. T. BOWDEN and E. T. BUTLER (J.C.S., 1939, 75—78).—The ebullioscopic const. of Me_2CO_3, and the d, n, η, γ, and $[P]$ of the carbonates of the homologous series (n- and iso-derivatives) Me_2CO_3 to $(C_6H_{13})_2CO_3$ are recorded and discussed. The carbonates have the non-polar structure in which the central C atom has a normal octet. The prep. of n-*hexyl carbonate*, b.p. 152—154°/20 mm., from C_6H_{13}·ONa and $COCl_2$ is described.   W. R. A.

Properties of vitreous phenolphthalein. E. RENCKER (Compt. rend., 1939, 208, 179—181).— At a const. annealing temp. (θ) the vol. of vitreous phenolphthalein (I) tends towards a const. val. (v) which is determined by θ and is independent of previous thermal treatment. The hysteresis is not observed for θ $<67°$ unless the (I) has been annealed previously at higher temp. The $v/θ$ curve consists of two straight lines intersecting at θ $= 67°$. The vol. after quenching is const. for θ $<67°$, and increases to another const. val. at θ $>86°$. Similar phenomena occur with B_2O_3 (A., 1938, I, 130), confirming a general analogy between vitreous substances.   A. J. E. W.

Free energy of ammonia. C. C. STEPHENSON and H. O. McMAHON (J. Amer. Chem. Soc., 1939, 61, 437—440).—The free energy of NH_3, calc. from the moments of inertia and the normal modes of vibration of the mol., increases from 37·989 g.-cal. per degree per mol. at 298·1° K. to 56·559 at 2000° K. The entropy over the same temp. range increases from 46·034 to 69·434 g.-cal. per degree per mol. The results have been correlated with published data and used to calculate equilibrium consts. for the Ostwald oxidation of NH_3 to NO.   E. S. H.

Properties of a perfect Einstein–Bose gas at low temperatures. R. H. FOWLER and H. JONES (Proc. Camb. Phil. Soc., 1938, 34, 573—576).— Mathematical.   F. J. L.

Grand partition functions and so-called "thermodynamic probability." E. A. GUGGENHEIM (J. Chem. Physics, 1939, 7, 103—107).— Mathematical. The relation between entropy and thermodynamic probability is considered in a precise form.   W. R. A.

Theory of actual gases. M. PAUL (Z. physikal. Chem., 1939, 183, 321—339).—Mathematical. The mutual effect of van der Waals' a and b is considered.   J. W. S.

Boyle–Mariotte law. B. PTÁČEK (Chem. Obzor, 1936, 11, 105—106; Chem. Zentr., 1937, i, 538).— Boyle's law for a real gas may be represented energetically, allowing for mol. attraction, as the locus of points of which the sum of the distances from two fixed points is const. Isotherms of real gases may also be plotted as the loci of points the products of the distances of which from two (or three) fixed points are const.   A. J. E. W.

Additivity of the van der Waals constant a and molecular association. N. BĂRBULESCU (Bul. Soc. Ştiinţe Cluj, 1938, 8, 32—39).—The sp. attractions (a/M) of 28 org. compounds calc. from their crit. consts. are in good agreement with the vals. obtained on the basis of the additivity of a/M (cf., A., 1937, I, 230). Anomalous results are due to mol. association, the degree of which is the ratio of the actual and theoretical vals. of the const. a.   W. R. A.

Solid–liquid equilibrium in argon. O. K. RICE (J. Chem. Physics, 1939, 7, 136—137).—The shape of the $(\delta E/\delta V)_T$ curve (cf. A., 1938, I, 507) is due probably to a change in the at. rearrangement when the vol. increases. A possible mechanism of the change is suggested.   W. R. A.

"Film" phenomenon of liquid helium II. B. V. ROLLIN and F. SIMON (Physica, 1939, 6, 219—230).—Experiments on the anomalous evaporation of liquid He II below the λ point, which prove that a film of the liquid "creeps" continuously over surfaces in contact with it, are described.   L. J. J.

Vapour pressure of xenon, the Lennard–Jones relation, and the constancy of T_e/T_k for the rare gases. K. CLUSIUS and K. WEIGAND (Z. physikal. Chem., 1939, 42, B, 111—116).—The v.p. of Xe has been measured between 161·4° and 273·2° K. Data obtained on the rare gases confirm the constancy of the ratio $(L_0 + U_0)/RT_k$ of Lennard-Jones, but a val. is found $\sim5\% >$ the theoretical val. of 6·45. For the rare gases the ratio of the m.p. to the crit. temp. (T_e/T_k) is const.   W. R. A.

Vapour pressure of lithium between 462° and 642°. (MLLE.) M. MAUCHERAT (Compt. rend., 1939, 208, 499—501).—The v.p. (p mm.) have been redetermined by an at. jet method; $\log_{10} p = 8·012 - 8172/T$; b.p., 1530° K.; $L = 36,600$ g.-cal. The results are in accord with Hartmann and Schneider's data for higher temp. (A., 1929, 754).   A. J. E. W.

Vapour pressure–temperature equation and Burnop's b.p. function. W. H. BANKS (J.C.S., 1939, 292—295).—Heats of vaporisation calc. from the const. B of the empirical v.p. equation $\log p = A - B/T$ are related approx. to the formula to the const. M by the empirical expression $\log \Delta H_0 = 4·93 - 4/M^{\frac{1}{4}}$. A derived additive function $4M^{\frac{1}{4}} + M \log T_B$, which $\propto M$, differs from that of Burnop (cf. A., 1938, I, 393) in that the coeff. of $M^{\frac{1}{4}}$ is 4 instead of 8. The above function is not constitutive, and it appears therefore that the constitutive nature of Burnop's function was due to the use of 8 as coeff. of $M^{\frac{1}{4}}$.   W. R. A.

Optical study of the liquid–vapour equilibrium in capillary systems. M. B. COELINGH (Diss., Urecht, 1938, 1—81).—The condensation of

vapours of various liquids on a weathered glass surface has been studied by an interferometric method, which gives results agreeing with those obtained by v.p. measurements. The v.p. curves are similar to those of van Bemmelen and indicate that the surface studied consists of a thin but composite layer containing capillary spaces of the size order 2—20 mμ. Hysteresis phenomena are attributed to the shape of the liquid meniscus, which is hemispherical during drying but cylindrical during re-wetting. The existence of " vaporisation nuclei " is established. The phenomena described are due to capillary condensation, not adsorption.   F. L. U.

Determination at pressures of 1—11,000 kg. per sq. cm. of an isotherm of tetrahydronaphthalene passing from the liquid to the solid state. J. BASSET (Compt. rend., 1939, **208**, 169—170).—The isotherm (18°) shows a change of state at 3200 kg. per sq. cm., with a decrease of mol. vol. from 122·9 to 117·4 c.c., corresponding with an internal energy increase of 0·412 kg.-cal. per g.-mol.   A. J. E. W.

Nature of pre-critical state. W. SWIENTOSŁAWSKI (Kolloid-Z., 1939, **86**, 145—150).—Apparatus for observation of phenomena at the crit. point is described. The appearance of mist on passing from the liquid to vapour is observed below the crit. temp. and pressure. As the pressure is gradually increased, boiling takes place with formation of foam and of a disperse system of liquid droplets in vapour; at higher pressures the particle size of the droplets diminishes, and at or above the crit. pressure vapour is formed without passing through an intermediate disperse system.   E. S. H.

Momentum and heat flow in liquid helium II. J. F. ALLEN and J. REEKIE (Proc. Camb. Phil. Soc., 1939, **35**, 114—122).—Both the conductivity and the reaction force of liquid He II vary with the temp. gradient. The temp.-dependence of the reaction force and of conductivity is obtained for two vals. of T, $1·25° \times 10^{-3}$ and $2·5° \times 10^{-3}$, respectively. The max. in the reaction curve is at $1·7°$ K., and that of the conductivity curve at $2·0°$ K. The velocity of the " heat carriers " is independent of the temp. gradient, and depends to some extent on the temp. but does not drop to zero as the temp. approaches the λ point. The connexion between heat transfer and momentum transfer was established by placing in the tube with the liquid He II some granules of paramagnetic Fe NH_4 alum. On magnetisation (in a field of 5000 gauss) the salt became heated and the He rose several cm. in the tube; demagnetisation produced a temporary lowering of the He, indicating that the direction of flow of liquid is in opposite sense to that of the flow of heat.   F. J. L.

Low-temperature properties of gaseous helium. H. S. W. MASSEY and R. A. BUCKINGHAM (Proc. Roy. Soc., 1938, **A, 169,** 205).—A correction (cf. A., 1939, I, 135).   G. D. P.

Dilatation of heavy water. K. STOKLAND, E. RONÆSS and L. TRONSTAD (Trans. Faraday Soc., 1939, **35,** 312—318).—The relative densities and vols. of D_2O have been determined at 10—27°. Assuming that for D_2O of normal $^{18}O/^{16}O$ ratio $d_{20}^{20} = 1·0726$ (A.,

1938, I, 364) it is deduced that $d_{25}^{25} = 1·0764$, a val. $<$ that recorded by Taylor and Selwood (A., 1934, 590). The temp. of max. d is $11·23 \pm 0·02°$, and $d_4^{11·23}$ is 1·10596. Data for D_2O of enriched ^{18}O content are also recorded.   J. W. S.

Thermal expansion of liquids. M. G. VESSELOV (Acta Physicochim. U.R.S.S., 1938, **9**, 373—375).—Weichherz's formula (A., 1938, I, 609) is criticised.   O. J. W.

Dilatation and polymorphism in fatty acids. F. D. LA TOUR (Compt. rend., 1939, **208**, 364—366; cf. A., 1934, 1060).—The coeff. of thermal expansion (c) of the parameter $a \sin \beta$ in polymorphic fatty acids shows an abrupt increase near a temp. in the neighbourhood of the α–β transition point. This increase is observed without change of cryst. form in monacids containing an even no., and in diacids with an odd no., of C atoms; with the non-polymorphic diacids containing even nos. of C, c is const. up to the m.p. The variation of the angle β with temp. is greater with the monacids.   A. J. E. W.

Thermal dilation of superconductors. E. C. WESTERFIELD (Physical Rev., 1939, [ii], **55**, 319).—Replotting on a magnified scale of the data of McLennan et al. on the thermal expansion of Pb and Rose's metal in the neighbourhood of their transition temp. shows, in each case, a previously unrevealed discontinuity.   N. M. B.

Viscosity of air. E. L. HARRINGTON (Physical Rev., 1939, [ii], **55**, 230).—A general crit. survey of available data and methods used in obtaining them.   N. M. B.

Viscosity of air and the electronic charge. A. FORTIER (Compt. rend., 1939, **208**, 506—507).—Determinations with a Poiseuille viscosimeter give $\eta_{23°} = (1834·1 \pm 1·9) \times 10^{-7}$ c.g.s. unit. Substitution of this val. in Millikan's calculations (cf. A., 1930, 977) gives $e = (4·813 \pm 0·010) \times 10^{-10}$ e.s.u., in agreement with the X-ray val. (A., 1936, 133).   A. J. E. W.

Effect of pressure on viscosity of n- and isobutane. B. H. SAGE, W. D. YALE, and W. N. LACEY (Ind. Eng. Chem., 1939, **31**, 223—226).—The η of gaseous and liquid n- and iso-C_4H_{10} has been determined over the temp. range 38—105° and for pressures up to 2000 lb. per sq. in., using the rolling-ball viscosimeter.   H. C. M.

Effect of an electric field on the viscosity of liquids. E. N. DA C. ANDRADE and C. DODD (Nature, 1939, **143**, 26—27).—Polar liquids, e.g., Et_2O, MeCN, $COMe_2$, $MeNO_2$, $CHCl_3$, and Me, Et, Pr, Bu, and amyl acetates, show an increase in η which at first is approx. $\propto$ the square of the transverse field and then reaches a saturation val., η_s. Repeated distillation diminishes the conductivity of the liquid and the val. of η_s which is $\propto$ the conductivity. The current passing through the badly-conducting liquids does not obey Ohm's law. Non-polar liquids show no change in η.   L. S. T.

Influence of the temperature and the specific volume on the viscosity of liquids II. W. R. VAN WIJK and W. A. SEEDER (Physica, 1939, **6**, 129—136; cf. A., 1938, I, 23).—Existing data at varying pressure for a no. of alcohols, paraffins, and other

liquids are considered in relation to the formula given previously. It is shown that the configurational energy term increases with the degree of internal structure of the liquid. Hg belongs to the class of non-configurational liquids. The increment of the mol. vol. per CH_2 is the same for n-paraffins and straight-chain primary alcohols.   L. J. J.

Theory of viscous flow reactions for chain-like molecular substances. F. EIRICH and R. SIMHA (J. Chem. Physics, 1939, 7, 116—121).—The lower esters of HCO_2H, AcOH, nonoic, nonenoic, and oleic acids have been investigated from the viewpoint of a relation for the coeff. of internal friction as a reciprocal reaction rate. The variation of the activation of the flow process with temp., mol. wt., and constitution is considered, and the correlation of the variation with mol. constitution is attempted. The relation between γ and η is discussed.   W. R. A.

Viscosity in an expanding bubble. E. C. WESTERFIELD and W. B. PIETENPOL (Physical Rev., 1939, [ii], 55, 306—307).—Mathematical.   N. M. B.

Relation between viscosity and elastic properties of amorphous substances. W. KUHN (Z. physikal. Chem., 1939, 42, B, 1—38).—A detailed account of work already noted (cf. A., 1938, I, 610).   W. R. A.

Pressure–volume–temperature relations in solutions. I. Solutions of benzene and some of its derivatives. R. E. GIBSON and O. H. LOEFFLER (J. Physical Chem., 1939, 43, 207—217).—The bulk compressions, k, of C_6H_6, PhCl, PhBr, $PhNO_2$, and NH_2Ph are satisfactorily reproduced by $k = C \log [(B + P)/B]$, where P is the pressure in bars, C is a const. independent of temp. and the same for each liquid, and B is a const. which decreases with rise in temp. and with increase in the attractive potential between the mols. and in the free vol. Sp. vol. data for solutions of NH_2Ph in C_6H_6, PhCl, and $PhNO_2$ show that whilst NH_2Ph and $PhNO_2$ or PhCl expand on mixing, NH_2Ph and C_6H_6 contract, the amount of contraction increasing with rise in temp. or decrease in pressure. C has the same val. for solutions as for pure liquids. An equation is derived which enables the compressibility of a solution to be calc. from the vol. changes on mixing, provided that the vols. and net internal pressures of the components are known. When NH_2Ph and $PhNO_2$ are mixed, a yellow colour is formed which becomes reddish on the application of hydrostatic pressure.   C. R. H.

Changes in volume and refractometer readings attending the mixing of Cellosolve and water and of Carbitol and water at 25°. L. McKINLEY and A. NIBARGER (J. Amer. Chem. Soc., 1939, 61, 373—375).—The sp. vol. curves of aq. solutions of Cellosolve ($OH\cdot[CH_2]_2\cdot OEt$) and Carbitol ($OH\cdot[CH_2]_2\cdot O\cdot[CH_2]_2\cdot OEt$) have been determined and expressed by means of equations. The region through which actual sp. vols. depart most from the ideal does not include the concn. at which the observed sp. vol. is a min., but coincides with the max. deviation of n from a straight line connecting the n of the components.   E. S. H.

Velocity of sound in binary liquid mixtures by a resonance method. C. SĂLCEANU (Compt. rend., 1939, 208, 83—85).—v/ρ curves (v = velocity of sound) are given for $EtOH$–H_2O and $COMe_2$–$BuOH$ at ~22°. The results are in approx. agreement with the Newton–Laplace relation. v in $EtOH$–H_2O and H_2O–$COMe_2$ reaches a max. for $\rho = 0.963$.   A. J. E. W.

Following the process of diffusion by [electrical] capacity determinations. P. TUOMIKOSKI (Suomen Kem., 1939, 12, B, 6—7).—The interdiffusion of two liquids of different dielectric const. has been studied by capacity measurements, the liquids forming the dielectric of a series of co-axial annular condensers. It has been confirmed that $C = f(d/\sqrt{t})$, where d is the distance from the boundary. Vals. of D at 25° for CH_2Cl_2 and PhCl in C_7H_{16} and for $PhNO_2$ in CCl_4 have been determined.   M. H. M. A.

Differential diffusion constants of hydrochloric and sulphuric acids. W. A. JAMES, E. A. HOLLINGSHEAD, and A. R. GORDON (J. Chem. Physics, 1939, 7, 89—92).—The differential diffusion consts. of aq. HCl (0·01—1·6 mols. per l.) and aq. H_2SO_4 (0·01—1·0 mol. per l.) have been determined at 25° with Northrop–McBain diffusion cells. The results are discussed in relation to the previously proposed expression for the variation of the diffusion const. with concn. (cf. A., 1937, I, 459).   W. R. A.

Phenylthiocarbamide–ethyl alcohol and carbamide–methyl alcohol systems and the Debye salting-out theory. R. W. WRIGHT, L. S. STUBER, and P. S. ALBRIGHT (J. Amer. Chem. Soc., 1939, 61, 228—230).—Measurements of the dielectric const. (ϵ) and d of $NH_2\cdot CS\cdot NHPh$–$EtOH$ mixtures at 25° and $EtOH$ at 28° are related to the salting-in characteristics of the system in a way which agrees qualitatively with the Debye theory. ϵ, d, and saturation data for $CO(NH_2)_2$–$MeOH$ at 25° are recorded. ϵ rises rapidly with increasing $[CO(NH_2)_2]$, indicating the probability that $CO(NH_2)_2$ will be strongly salted-in if salts are added.   E. S. H.

Effect of potential on the dispersion of the dielectric constants of strong electrolytes. F. FRÖLICH (Physikal. Z., 1939, 40, 124—140).—Theoretical. The Wien potential effect and the Debye–Falkenhagen time–dispersion effect are combined for symmetrical electrolytes, the ions being supposed to have the same mobility. The effect of concn., the dielectric const. of the solvent, temp., and valency on the variation of dielectric const. of the electrolyte with increasing field strength and frequency was investigated.   A. J. M.

Magnetic rotatory power of electrolytic ions. R. DE MALLEMANN and F. GUILLAUME (Compt. rend., 1939, 208, 436—438).—An accurate and comprehensive study of the rotatory power and dispersion of electrolyte solutions shows that Verdet's law is rarely obeyed. In general the sp. rotation (ω) falls with increasing concn., indicating ionic deformation. Const. differences of ionic rotatory power are obtained on comparing dil. solutions containing a common ion; conc. solutions are comparable only when the ions concerned are analogous (e.g., Cl′, Br′).

Abs. vals. of ω for a no. of ions are deduced from the relative vals., the deduction being based on the small ω val. for H·, and on the constancy of ω for org. acids in solution and in the pure state.　　　　A. J. E. W.

Tests of the validity of Beer's law for copper salt solutions, using the alkali-metal photo-cell. H. EICKE (Zentr. Min., 1936, A, 277—286; Chem. Zentr., 1937, i, 283).—Beer's law is valid for aq. $CuSO_4$, $CuCl_2$, and $Cu(NO_3)_2$ (0·5—2 M.) only in restricted spectral regions, the deviation varying with λ.　　　　A. J. E. W.

Statistical mechanics of co-operative assemblies. E. A. GUGGENHEIM (Proc. Roy. Soc., 1938, A, 169, 134—148).—A general statistical treatment of regular assemblies is given. A regular assembly is defined as a co-operative assembly with certain properties analogous to those of regular solutions. The definition includes mixed crystals, solutions of H in Pd, and monolayers.　　　　G. D. P.

Alloys as chemical systems. Their technical applications. G. MASING (Naturwiss., 1939, 27, 137—145).—A lecture.　　　　A. J. M.

Lithium alloys. Thermal and X-ray analysis of the systems lithium–zinc and lithium–magnesium. A. BARONI (Congr. int. Quim. pura apl., 1934, 9, II, 464—470; Chem. Zentr., 1937, i, 531; cf. A., 1934, 137, 954).—The system Li–Zn gives the compounds Li_2Zn_3 (m.p. 510°) and $LiZn_4$, eutectics occurring at 188°, 472°, and 394°. Li_2Zn_3 is cubic, a 4·26 A., calc. d 4·52. $LiZn_4$ is probably hexagonal. In the system Li–Mg two series of mixed crystals occur, with a miscibility gap at 70—85% Mg; the first series (<70% Mg) is cubic (a 3·491—3·306 A.) and the second is hexagonal. The occurrence of Li_2Mg_5 (cubic, a 3·506 A.) is indicated by thermal analysis.　　　　A. J. E. W.

Factors affecting the limit of solubility of elements in copper and silver. E. A. OWEN and E. W. ROBERTS (Phil. Mag., 1939, [vii], 27, 294—327).—The crystal parameters of primary solutions of Cd, In, Sn, and Sb in Ag and of Zn, Ga, Ge, and As in Cu have been accurately determined. The boundaries of the α-phases have been determined for the Ag alloys by the X-ray method. The parameter factors are approx. independent of temp. The lattice distortion is affected by the valency of the solute element but is not $\propto$ it; the ratio of the distortions produced per atom of Cd, In, Sn, and Sb in Ag is 2 : 3 : 4 : 6 and of Zn, Ga, Ge, and As in Cu is 3 : 4 : 5 : 7. The max. lattice distortion is directly $\propto$ the product of the at. vol. and the max. solubility plus a const.; for the Cu alloys this const. is zero. The electron concn. (ratio of valency electrons to atoms) corresponding with the max. solubility has been calc. for both series of alloys. The % distortion diminishes with the electron concn. but at a greater rate.　　　　D. F. R.

Diffusion of hydrogen and deuterium through iron. I. Iron as cathode in a glow discharge. A. GÜNTHER-SCHULZE, H. BETZ, and H. KLEINWACHTER (Z. Physik, 1939, 111, 657—679).—Apparatus is described for measuring the amount of diffusion of H and D through Fe plates, the latter forming the cathode in a glow discharge in the gas. H diffuses as H^+ and as H atoms. The diffusion const. for the former (almost independent of T) is ~5—10 sq. cm. per day and for the latter (rising logarithmically with T) at 0° is ~0·7 sq. cm. per day. Conditions for hindering diffusion (e.g., preliminary discharge in A) are discussed and the behaviour of other metals is compared.　　　　L. G. G.

Diffusion in solid metals. Influence of microstructure. F. N. RHINES and C. WELLS (Metal Ind. (Lond.), 1938, 53, 557—561).—Recrystallisation, grain growth, and twinning due to diffusion of Zn in α-brass have been observed. It is concluded that these effects are set up when relatively large sp. vol. changes are caused by movement of the solute. The shape and grain structure of the specimen have also an important influence. New evidence for an anisotropy of diffusion in the Cu–Zn system has been found, this being dependent on the solute concn. Previous work on intergranular diffusion is critically discussed.　　　　C. E. H.

β-Brass in single crystal form. W. WEBB (Physical Rev., 1939, [ii], 55, 297—305).—Resistances of 20 single-crystals of β-brass were measured as a function of temp. from room temp. to ~ 550°, and results are compared with the Bragg–Williams theory. The resistivities at 25° as a function of composition limit the β-phase to 51·3—55·5 at.-% Cu. The thermal e.m.f. of the crystals against Cu shows only a slight discontinuity in the second derivative of the e.m.f.–temp. curve at the temp. of complete disorder. Young's modulus and elastic behaviour are measured and discussed.　　　　N. M. B.

X-Ray methods in the investigation of aluminium alloys. W. HOFMANN (Aluminium, 1938, 20, 865—872).—The application of the Debye–Scherrer method is illustrated by identification of Al_3Fe as the heavier constituent in the ternary eutectic of the system Al–Fe–Mg. In using the reflected-ray method the surface of quenched specimens must be removed by turning and then a further 0·1 mm. removed by etching to remove the plastically deformed metal. This method is illustrated by solubility measurements for the Al corner of the Al–Cu–Mn phase diagram, and investigations of supersaturated solutions on Mn in Al. The rotating-crystal method is illustrated by reference to its use in identifying intermediate phases in the system Al–Mg–Mn. Al_6Mn is rhombic with a 6·51, b 7·57, c 8·87 A., and Al_4Mn is hexagonal with a 28·35, c 12·36 A. Two other cryst. phases of unknown composition have also been detected. The rotating-crystal reflected-ray method can be used to detect mixed crystal formation. The use of X-ray methods in detecting recrystallisation is also discussed.　　　　J. W. S.

Equilibrium relations in aluminium–zirconium alloys of high purity. W. L. FINK and L. A. WILLEY (Amer. Inst. Min. Met. Eng., Tech. Publ. 1009, 1939, 12 pp.; Met. Tech., 1939, 6, No. 1).—The Al end of the Al–Zr system has been investigated, using alloys containing 0—2% Zr. The equilibrium relations are summarised in a diagram. A peritectic occurs at 660·5° between the melt containing 0·11%

Zr and α-Al–Zr (I) to form a solid solution containing 0·26% Zr. As the temp. falls the solid solubility decreases from 0·26% Zr at the peritectic temp. to ~0·05% at 500°. The Zr-rich constituent (I) consists of very stable tetragonal crystals which are not discoloured or attacked by ordinary etching agents. Chemical analysis shows that (I) has a composition corresponding with Al_3Zr.   R. B. C.

System Mn–Bi. F. HALLA and E. MONTIGNIE (Z. physikal. Chem., 1939, **42**, **B**, 153—154).—From powder photographs the X phase appears to be Mn_2Bi_3 rather than Mn_2Bi (cf. A., 1938, I, 305, 447).   W. R. A.

Relations between the Curie point, the orbital moment, and the crystal lattice. R. FORRER (Compt. rend., 1939, **208**, 175—177).—The Curie point of Co–Ni and Fe–Ni alloys is dependent only on the orbital component of the elementary moment (cf. A., 1939, I, 70); a small val. of this component limits the no. of orbital interactions in the lattice (N). When the orbital component is large N is determined by the no. of adjacent atoms.   A. J. E. W.

System iron–chromium–phosphorus. R. VOGEL and G. W. KASTEN (Arch. Eisenhüttenw., 1939, **12**, 387—391).—The binary system Cr–P contains Cr_2P, m.p. ~1640°, and Cr_3P, m.p. incongruent ~ 1520°; also a Cr–Cr_3P eutectic, m.p. 1375°. The ternary system was investigated within the boundaries Fe–Fe_2P and Cr_2P–Cr, i.e., up to 28% P. Four solid phases (mixed crystals) occur : Fe + Cr + P (I), Fe_3P + Cr_3P (II), Fe_2P + Cr_2P (III), and a P-rich crystal (IV) of unknown composition. No four-phase points occur. Three three-phase equilibria between a liquid and two solid phases were delineated : (1) melt + I + II; (2) melt + II + III; (3) melt + III + IV.   R. C. M.

Solubility in water of carbon dioxide at 50°, 75°, and 100°, at pressures to 700 atmospheres. R. WIEBE and V. L. GADDY (J. Amer. Chem. Soc., 1939, **61**, 315—318).—Data are recorded for the ranges given. Agreement was obtained with solubilities at 75° and 100° calc. according to the theory of dil. solutions. CO_2 shows a min. of solubility, although only in the higher-pressure range.   E. S. H.

Solubility of nitrogen and oxygen in liquid sulphur dioxide. R. W. DORNTE and C. V. FERGUSON (Ind. Eng. Chem., 1939, **31**, 112—113).—Apparatus suitable for measurements with 2 c.c. of liquid is described. Tests (−20° to −60°) without (static) and with circulation of the gas through the SO_2 were in close agreement. The relation between log γ (γ = c.c. of gas at n.t.p. dissolved by 1 g. of SO_2 at 1 atm.) and $1/T$ is linear. For N_2, log γ = $8\cdot729 - 8180/4\cdot58T$, and for O_2, $9\cdot710 - 9650/4\cdot58T$. The temp. coeff. of solubility indicates that dissolution of these gases in SO_2 is endothermic, involving 8000 g.-cal. per mol. for N_2, and 10,000 for O_2. Bubbling O_2 through 4·8 g. of liquid SO_2 for 4 hr. at 0° produced 1 mg. of SO_3.   I. C. R.

Solubility of gases in mixtures of water with non-electrolytes. G. THURY (Acta chem., min. phys. Univ. Szeged, 1936, **5**, 135—147; Chem.

Zentr., 1937, i, 511).—The solubilities (S) of H_2S and CO_2 in aq. EtOH, $COMe_2$, glycerol (I), and $CO(NH_2)_2$ (II) at 25° and 0·05° have been determined. Setschenov's formula (A., 1889, 1044) does not apply, that of Jahn (Gordon, A., 1896, ii, 154) being in approx. agreement with the data for (I) and (II). The variation of S, S_0/S, and the differential heat of dissolution with the concn. of non-electrolyte is sp.   A. J. E. W.

Energy and volume relations in the solubilities of some ketones in water. P. GROSS, J. C. RINTELEN, and J. H. SAYLOR (J. Physical Chem., 1939, **43**, 197—205).—Solubility data at 10°, 30°, and 50° are recorded for $COMePr^a$, $COMePr^\beta$, $COEt_2$, $COMeBu^a$, and $COBu^a_2$, and additionally at 0° and 75° for $COMeBu^\beta$ and $COPr^a_2$. Increasing the chain length up to $COPr^a_2$ results in increased vals. for the heat of dissolution, ΔH, although in $COBu^a_2$ ΔH is < in $COPr^a_2$. There is also a reduction in ΔH when passing from n- to iso-compounds. For liquids with approx. equal mol. vols., there is a linear relation between ΔH and entropy of solution. Although $COMeBu^a$ and $COMeBu^\beta$ have approx. the same mol. vol., their solubilities differ greatly at 10°, but less at higher temp. Similar behaviour is observed with other pairs of compounds of equal mol. vol. An explanation is offered.   C. R. H.

Aqueous solubility of ββγ-trimethylpentan-γ-ol. P. M. GINNINGS and D. COLTRANE (J. Amer. Chem. Soc., 1939, **61**, 525).—The mutual solubilities of H_2O and $CMeEtBu^\gamma$·OH (prep. from COMeEt and $MgBu^\gamma Hal$), b.p. 153—154°, are the highest in the C_8H_{17}·OH series.   R. S. C.

Effect of pressure on the solubility of solids in liquids. R. E. GIBSON (Amer. J. Sci., 1938, [v], **35**, A, 49—69).—From analysis of existing data it is shown that the solubility of a solid in a liquid is generally not raised by pressure, but exceptions occur in the carbonates, sulphates, sulphides, fluorides, and hydroxides of some alkali metals, the alkaline-earth metals, and the heavy metals in H_2O, especially where the saturated solutions are very dil. The effect of pressure is correlated qualitatively with the types of cohesive forces in the pure components and the solutions involved. The solubility of CsBr in H_2O at pressures up to 1500 atm. and the partial vols. of NaCl at 1 and 1000 bars pressure and 25—95° have been determined.   E. S. H.

Solubility in systems containing alkali and water. I. Introduction. II. Filter autoclave for solubility measurements at elevated temperatures and atmospheric pressure. III. Solubility of sodium hydroxide in a saturated sodium carbonate solution between 60° and 70°. G. W. MOREY and J. S. BURLEW (Amer. J. Sci., 1938, [v], **35**, A, 185—193, 193—202, 202—215).—I. Published work is discussed.

II. Apparatus for determining solubilities by the analytical method is described. A mixture of solid + liquid at const. temp. is stirred in a Ag vessel and filtered through a Pt felt, after which the filtrate is cooled and analysed.

III. The above apparatus has been used for the determination of the position of the boundary between

the field of Na_2CO_3 and the fields of $NaOH,H_2O$ and NaOH at 60—70°. The ternary eutectic is at 62·5° and 56·60% of Na_2O. The optical properties of NaOH and $NaOH,H_2O$ have been determined.
E. S. H.

Thermodynamical calculation of the solubility of some important sulphides up to 400°. J. VERHOOGEN (Econ. Geol., 1938, **33**, 775—777).—Solubilities of the sulphides recorded previously (A., 1938, I, 306) are recalc. on the basis of Kelley's data (ibid., 198). The solubility of Cu_2S_a given previously (ibid., 306) is in error; it does not decrease with rise in temp.
L. S. T.

Crystal growth. D. BALAREV [with N. KOLAROV] (Z. Krist., 1938, **100**, 167—170).—The solubilities of (a) fresh and (b) old gypsum crystals in H_2O at 23° have been determined from both above and below the saturation point. In accord with the author's views on growth and equilibrium in cryst. conglomerates (e.g., A., 1934, 148), vals. for (a) by both methods (0·2104 g. of $CaSO_4$ per 100 g. of solution) agree with those for (b) by deposition; vals. for (b) by dissolution are 1% lower at 0·2082 g.
I. McA.

Solubility of calcium oxalate in aqueous solutions of carbamide. K. J. PEDERSEN (J. Amer. Chem. Soc., 1939, **61**, 334—336).—The solubility at 25° in 0—2M-$CO(NH_2)_2$ is given by $s = 4·84 \times 10^{-5}(1+0·19[CO(NH_2)_2])$, where the concns. are expressed in mol. per l. of solution.
E. S. H.

Solubility of red, yellow, and black lead oxides and hydrated lead oxide in alkaline solutions. Character of the lead-bearing ion. A. B. GARRETT, S. VELLENGA, and C. M. FONTANA (J. Amer. Chem. Soc., 1939, **61**, 367—373).—Solubility data for a range of [NaOH] are recorded. The degree of dissociation of red and yellow PbO is approx. 80%. The free energy of the reaction $PbO+OH' \rightarrow HPbO_2'$ is +1550 g.-cal. for yellow PbO and +1830 g.-cal. for red PbO. The free energy difference between red and yellow PbO is 280 g.-cal. The ionisation const. for $Pb(OH)^{\cdot} = Pb^{\cdot\cdot} + OH'$ is $1·5 + 10^{-8}$.
E. S. H.

Solubility of lead sulphate in solutions of sulphuric acid, determined by dithizone with a photronic cell. D. N. CRAIG and G. W. VINAL (J. Res. Nat. Bur. Stand., 1939, **22**, 55—70).—Using dithizone (diphenylthiocarbazone) as the reagent the solubility of $PbSO_4$ in aq. H_2SO_4 (0·1—50% H_2SO_4) has been accurately measured at 0° and 25°. The equivalence point was detected by an arrangement of photronic cell and colour filter. New max. and min. were found in the solubility curves. The curves for $PbSO_4$ and Hg_2SO_4 are very similar, but the latter is ~80 times more sol. than $PbSO_4$.
W. R. A.

Chemical compositions and water-solubilities of glasses.—See B., 1939, 263.

Superlattice formation of the type AB in an adsorbed layer. T. S. CHANG (Proc. Camb. Phil. Soc., 1939, **35**, 70—83).—The formation of a superlattice of the type AB, in which the sites of accommodation on the solid surface are regularly arranged,

and where alternate sites have the same probability of adsorption, is considered.
F. J. L.

Statistical theory of adsorption. II. Theory of two-layer adsorption with correlation in the first layer. G. P. DUBE (Proc. Camb. Phil. Soc., 1938, **34**, 587—598; cf. Cernuschi, A., 1938, I, 510).—There is a possibility of crit. condensation phenomena in a two-layer adsorption when the second layer mols. are bound more tightly than the first layer mols. to the surface of the adsorbent (i) when there is no interaction between the adsorbed mols., (ii) when there is attractive force between them.
F. J. L.

Sorption velocity of gases by porous substances. I. E. WICKE (Kolloid-Z., 1939, **86**, 167—186).—A detailed account of work already reported (A., 1938, I, 569).
E. S. H.

Adsorption of gases by graphite. II. A. B. LAMB and E. N. OHL (J. Amer. Chem. Soc., 1939, **61**, 528—529; cf. A., 1938, I, 395).—Further measurements support the previous conclusion that pseudomorphs of graphite obtained by heating SiC do not contain any inner porosity accessible to H_2 but not to CO_2 or CCl_2F_2 beyond that present in ordinary graphite.
E. S. H.

Sorption of hydrogen on supported nickel. C. W. GRIFFIN (J. Amer. Chem. Soc., 1939, **61**, 270—273).—At —196° a step-wise increase of adsorption with increasing pressure was observed and poisoning with CO decreased the low-pressure adsorption in approx. proportion to the amount of CO used. Dissolution of H_2 in Ni occurs to a slight extent at 0°. A small amount of CO causes a slight increase in adsorption of H_2 at —78·5°.
E. S. H.

Adsorption values of porphyrins. F. BANDOW (Z. physikal. Chem., 1939, **42**, B, 155—157).—The adsorption vals. of proto-, pyrro-, hæmato-, and ætioporphyrin on Al_2O_3 and kaolin have been measured in solution. In HCl (5%) the adsorption val. for kaolin is $\gg$ for Al_2O_3 whilst in EtOH or dioxan solution the adsorption val. for Al_2O_3 is $>$ for kaolin.
W. R. A.

Theory of adsorption when each particle occupies more than one site. J. K. ROBERTS (Proc. Camb. Phil. Soc., 1938, **34**, 577—586).—The statistics and kinetics of films in which each mol. is assumed to cover more than one site are considered.
F. J. L.

Ageing of surfaces of solutions. IV. Nature of the potential limit which hinders the concentration of molecules of dissolved substance in the surface of solutions. K. S. G. DOSS (Kolloid-Z., 1939, **86**, 205—213; cf. A., 1938, I, 511).—The variation with time of the surface tension of solutions of cetylpyridinium and cetyltrimethylammonium bromide is too slow to be accounted for in terms of diffusion. The potential limit formerly postulated is attributed to a diffuse electric double layer. The influence of concn., presence of electrolytes, and p_H has been investigated.
E. S. H.

Mechanical properties and stabilising effect of adsorption layers and their dependence on

surface concentration. I. P. A. REHBINDER and A. A. TRAPEZNIKOV (Acta Physicochim. U.R.S.S., 1938, **9**, 257—272; cf. A., 1938, I, 453).—The mechanical properties of surface layers (η, elasticity, and tensile strength) increase with increasing concn. of the adsorption layer to a max. val. at complete saturation. Data for aq. saponin solutions and for films of cetyl alcohol and of palmitic and oleic acid are recorded. The stabilising action of adsorption layers on foams attains a max. at surface concn. somewhat $<$ the saturation val.   O. J. W.

Mechanical properties of adsorption layers of insoluble fatty acids and alcohols on water and the influence of the p_H of the substrate on these properties. II. A. A. TRAPEZNIKOV (Acta Physicochim. U.R.S.S., 1938, **9**, 273—312; cf. A., 1937, I, 358; also preceding abstract).—An apparatus for the measurement of η, elasticity, and tensile strength of films of surface-active substances insol. in H_2O is described. Measurements with films of palmitic acid and of cetyl alcohol on substrates of varying acidity show that these properties increase to a max. for the fully saturated adsorption layer. The influence of the p_H of the substrate on the mechanical properties of the film is discussed. The complete curves of the variation of the properties with surface concn. of active substance show two sharp increases. The first of these occurs at concn. $\ll$ the saturation val. of the layer and corresponds with the stage at which the micelles in the film come into contact. The effect of ageing of the films on the mechanical properties has also been studied. Films of oleic acid have a very low η.   O. J. W.

Effect of hydroxyl-ion concentration (or of p_H) on the film potential of multilayers. W. D. HARKINS and R. W. MATTOON (Physical Rev., 1939, [ii], **55**, 320—321; cf. A., 1938, I, 453).—Variations of film potentials of various thicknesses of X- and Y-type depositions of Ca stearate and of $CaCl_2$ on Au were investigated in relation to film thickness and p_H of the solution. Results indicate that the latter is one of the primary factors determining film potential.   N. M. B.

Phenomena of wetting and adhesion of bubbles. I. A. FRUMKIN. II. **Mechanism of the adhesion of bubbles to a mercury surface.** A. FRUMKIN and A. GORODETZKAJA (Acta Physicochim. U.R.S.S., 1938, **9**, 313—326, 327—340).—I. The theory of wetting and the influence of thickness and of surface tension on the stability of thin films are discussed.

II. The adhesion of H_2 bubbles to a Hg surface in solutions of Na_2SO_4 of varying concn. has been studied. Adhesion, which is instantaneous if the surface is not electrically charged, becomes hindered with increase of surface charge and decrease of [Na_2SO_4]. The stabilising effect of an electrical double layer on H_2O films on a Hg surface is discussed.   O. J. W.

Movement of water from concentrated to dilute solutions through liquid membranes. H. M. CASSEL and G. D. MILES (Science, 1939, **89**, 58; cf. A., 1939, I, 140).   L. S. T.

Mechanical properties and permeability of membranes of cellulose acetate.—See B., 1939, 250.

No more colloids! J. VALLÉE (Rev. Gén. Mat. Col., 1939, **43**, 41—45).—It is argued that a useful purpose is no longer served by according special treatment to colloids and the colloidal state.   F. L. U.

Absorption of aerosols in liquids. H. ENGELHARD and W. SCHILLKE (Kolloid-Z., 1939, **86**, 213—219).—The absorption of NH_4Cl smokes by aq. NaOH is controlled solely by the particle size of the NH_4Cl and the size of the gas bubbles. In the absorption of CO_2 the rate of transfer of particles (mols.) to the liquid boundary is much greater, and absorption depends on [OH].   E. S. H.

Nature of foam. III. **Foam formation of the ternary system, acetic acid–benzene–water.** T. SASAKI (Bull. Chem. Soc. Japan, 1939, **14**, 3—8; cf. A., 1939, I, 141).—A diagram showing the relation between the degree of foam formation and composition of the liquid ternary system $AcOH-C_6H_6-H_2O$ (i) has been constructed from measurements with a shaking apparatus. The foam formation of the homogeneous system, which is analogous to that of the system $AcOH-Et_2O-H_2O$ (ii), shows two max. In the heterogeneous system, however, in contrast to the mere emulsion droplets containing bubbles in (ii), remarkable foam formation can be observed in (i). An explanation of foam formation in heterogeneous (i) is suggested.   W. R. A.

Preparation of colloids using ultrasonic waves. N. MARINESCO (Bull. Soc. roum. Phys., 1934, **36**, No. 63/64, 181—189; Chem. Zentr., 1937, i, 804).—The prep. and properties of dispersions of Wood's and Rose's metals and Hg in H_2O, petroleum, and alcohols, and of Na and K in petroleum or heavy oil, are discussed. The particle size is not dependent on the frequency, but only on the amplitude of vibration of the quartz plate.   A. J. E. W.

Determination of the size and axial relations of ellipsoidal solid particles from the internal friction of dilute suspensions. A. PETERLIN (Kolloid-Z., 1939, **86**, 230—241).—Theoretical.   E. S. H.

Electrocrystallisation of metals. II. **Ultramicroscopic study of the process.** G. S. VOZDVISHENSKI (J. Appl. Chem. Russ., 1938, **11**, 1123—1128; cf. A., 1938, I, 617).—The colloidal solutions obtained by electrolysis of dil. aq. $AgNO_3$ or $HgNO_3$ contain oxide, but not metal, particles.   R. T.

Structure of blue gold sols. Y. BJÖRNSTÅHL (Kolloid-Z., 1939, **86**, 219—222).—Magnetic double refraction and optical tests on blue Au sols prepared by reduction of $AuCl_3$ with different reagents show that these sols consist at least partly of oxide.   E. S. H.

Nature of aluminium oxyiodide hydrosols as revealed by their action on hydrogen peroxide. A. W. THOMAS and B. COHEN (J. Amer. Chem. Soc., 1939, **61**, 401—403).—Bound I is more reactive in catalysing H_2O_2 decomp. than is free I', thus providing a technique for investigating equilibrium between free

I' and that bound by the micelles. Tests with the sols show that H_2O can displace bound I, addition of KI causes relatively small amounts of I to become bound, and ageing at room temp. causes part of the bound I to become free. The results are explained on the assumption that the micelles are polyolated and polyoxolated structures.   E. S. H.

Hydrous oxide hydrosols and gels. A. GANGULI (Acta Physicochim. U.R.S.S., 1938, 9, 197—201).—Freshly-prepared sols and gels of hydrous oxides are amorphous and consist of long-chain complexes. On ageing and on desiccation they become cryst. Various characteristics are discussed from the viewpoint of imperfect crystals and the amorphous state.   W. R. A.

Layer thickness of dispersion medium in a plastic mica suspension. M. P. VOLAROVITSCH and J. S. JEROCHIN (Acta Physicochim. U.R.S.S., 1938, 9, 89—92).—The measurement of particle size, plasticity, and the layer thickness of the dispersion medium on the particles of a mica suspension in a non-polar vaseline oil are discussed.   W. R. A.

Neutralisation of colloidal hydrosols having an acid reaction. A. BOUTARIC and (MLLE.) M. BRETON (Bull. Soc. chim., 1939, [v], 6, 274—279).—Changes in p_H and in interfacial tension during the neutralisation of hydrosols of As_2S_3, clay, gum mastic, and humic substances have been investigated. The data are not explainable by the law of mass action, since neutralisation is complicated by the necessity of breaking down the micelloidal state.   C. R. H.

Application of N. S. Kurnakov's pyrometer in the investigation of gelatinisation of potato starch. V. I. NAZAROV and A. V. NIKOLAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 569—570).—The formation of a gel from a suspension of potato starch is followed with a recording pyrometer; the transition takes place at 60°, and is endothermic.   J. D. R.

Pasting of starch. III. Relation between hydration and pasting. IV. Influence of treatment with chromic salts on the formation of starch paste. A. KÜNTZEL and K. DOEHNER (Kolloid-Z., 1939, 86, 254—257, 258—262; cf. A., 1939, I, 141).—III. The pasting of starch is associated with a contraction of vol. of the system starch + water, owing to hydration of starch mols. The H_2O content required for pasting is about 20%.

IV. Starch paste is tanned by treatment with a solution of Cr alum and Na_2CO_3; the product when dried is resistant to boiling H_2O. The temp. of formation of paste with the Cr-treated starch is 10° > with native starch, owing to hydrolytic degradation of the starch by free acid in the Cr solution.
            E. S. H.

Colloid physics and biophysics of proteins. G. C. HERINGA (Chem. Weekblad, 1939, 36, 131—140).—A lecture.   F. L. U.

Viscosities of solutions of the proteins of horse serum.—See A., 1939, III, 320.

Swelling and solubility of high-molecular materials in organic solvents. W. OSTWALD (J. Oil Col. Chem. Assoc., 1939, 22, 31—44).—A review of work of Moll (A., 1939, I, 142).   F. L. U.

Theory of elasticity, viscosity, and swelling in polymeric rubber-like substances. J. FRENKEL (Acta Physicochim. U.R.S.S., 1938, 9, 235—250).—The relation between van der Waals forces and thermal motion in long-chain rubber-like substances is discussed. A quant. theory of the elastic properties of such substances is developed, which also accounts for the elastic relaxation time necessary for the establishment of equilibrium. The swelling of highly polymerised substances is considered as a kinetic process of an osmotic character, in which the surface of the polymeride plays the same part as a semipermeable membrane in ordinary osmosis.
            O. J. W.

X-Ray diffraction patterns of crystalline sol rubber prepared from ethereal solution. G. L. CLARK, S. T. GROSS, and W. H. SMITH (J. Res. Nat. Bur. Stand., 1939, 22, 105—107).—Using a modification of the technique previously described (B., 1933, 641) a pattern of cryst. sol rubber from Et_2O has been obtained which is identical with those for cryst. gel rubber and "frozen" sol rubber.
            W. R. A.

Micellar structure of fibrous substances. I. Micellar orientation as a function of the degree of stretching. S. OKA (Kolloid-Z., 1939, 86, 242—245).—A mathematical treatment.
            E. S. H.

Orthokinetic coagulation due to oscillations. J. J. HERMANS (Rec. trav. chim., 1939, 58, 164—173).—Theoretical.   E. S. H.

Non-thermal action of electrical oscillations on colloids. W. KRASNY-ERGEN (Hochfrequenztechn. u. Elektroakustik, 1936, 48, 126—133; Chem. Zentr., 1937, i, 549).—The effects of electric fields on the aggregation and rate of sedimentation of colloidal particles, and on the nature of the interfaces and viscosity of dispersions, are discussed.   A. J. E. W.

Influence of an ultrasonic field on the rate of coagulation of negative silver iodide sols by electrolytes. J. J. HERMANS (Rec. trav. chim., 1939, 58, 139—163).—The rate of coagulation by NH_4Cl, $NaNO_3$, KNO_3, and $BaCl_2$, as determined from the change in Tyndall effect, conforms with Paine's equation (A., 1912, ii, 337). The rate is accelerated by ultrasonic waves to an extent which is negligible at high electrolyte concns. and becomes more pronounced as the electrolyte concn. is decreased. In absence of ultrasonic waves the rate of slow coagulation is $\propto$ concn. of the sol, but when an ultrasonic field is applied the rate increases more rapidly with concn. The influence of ultrasonic waves is ascribed to the dipolar interaction of the particles, which results from the distortion of the electric double layer.   E. S. H.

Physicochemical study of the action of alcohol on gum arabic solutions. A. BOUTARIC and (MME.) M. ROY (Bull. Soc. chim., 1939, [v], 6, 316—322).—With increasing [EtOH], the relative η decreases with increasing rapidity, and the opacity, after remaining const. up to ~50% of EtOH, increases

rapidly as flocculation takes place. The reduction of η is attributed to dehydration reducing the particle size. A gum arabic solution which has been heated at b.p. for $3\frac{1}{2}$ hr. prior to the addition of EtOH shows reduced vals. for η and increased opacity.

C. R. H.

Coacervation. I. Experimental. (Mme.) A. DOBRY (J. Chim. phys., 1938, 35, 387—394).—The conditions of formation of coacervates of polystyrenes and cellulose acetate are described and discussed. Coacervation may be effected by pptn. or dispersion, using solvents such as CCl_4, $CHCl_3$, or $C_2H_2Cl_4$ and adding small quantities of aliphatic alcohols. Coacervation was never obtained using pure liquids. The coacervate obtained was stable, rigidity measurements showing it to be a liquid, not a gel. The interfacial tension between coacervate and solution is very small. Since unequal concns. of solvent are found in the coacervate and in the solution with which the coacervate is in equilibrium, a direct proof by chemical analysis is given of the solvation of mols. in solution.

F. H.

Influence of organic non-electrolytes on oleate and phosphatide coacervates. III. (f) Influence of temperature on oleate coacervates and details of the " volume " method. (g) Action of some alcohols on oleate coacervates under different conditions of temperature and potassium chloride concentration. H. G. B. DE JONG, G. G. P. SAUBERT, and H. L. BOOY (Protoplasma, 1938, 29, 481—497; cf. A., 1938, I, 573).—A modification of the method of measuring vol. changes is described which largely eliminates the influence of small temp. changes in the case of oleate coacervates. At const. temp. the vol. changes produced by alcohols become smaller as the KCl concn. is increased; with const. [KCl] the vol. changes decrease with increasing temp.

M. A. B.

Electrokinetic potential at gas–liquid interfaces. I. Cataphoretic velocity of gas bubbles in solutions of inorganic electrolytes. N. BACH and A. GILMAN. **II.** Cataphoresis of gas bubbles in solutions of capillary-active organic electrolytes. A. GILMAN and N. BACH (Acta Physicochim. U.R.S.S., 1938, 9, 1—26, 27—38).—The true cataphoretic velocity v of H_2 bubbles in H_2O (I), and in aq. KCl (II) and aq. $ThCl_4$ (III) has been determined by a method which takes into account the electro-osmotic flow of the liquid in a cell. In (I) and (II) the charge on the bubbles is negative and v corresponds with a ζ-potential of ~ -30 mv. In (III) the charge on the bubble remains negative at all concns. up to 10^{-3}N., and the apparent reversal of charge at 10^{-5}N. is caused by the carrying away of bubbles by H_2O, which moves towards the cathode with a velocity $>$ that with which the bubbles move towards the anode; $v_{III} \sim v_I$ and v_{II}. Changes in [KCl] and [$ThCl_4$] have little effect on v.

II. The bubble has a positive charge in aq. NBu_4Cl and $N(C_5H_{11})_4Cl$ at concns. (c) $>10^{-6}$ mol. per l. The ζ-potential (and hence v) is approx. $\propto \log c$. The ratios of [NBu_4Cl] and [$N(C_5H_{11})_4Cl$] which correspond with the same effects are const. and $=9$. Na palmitate gives the bubble a negative charge which

increases with concn.; the ζ-potential also increases at the liquid–glass interface.

W. R. A.

Electrokinetic behaviour of platinum at different potentials. N. BALASCHOVA and A. FRUMKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 449—452).—The potential and the deflexion of a fine Pt wire immersed in an electrolyte between two charged plates have been determined under various conditions. Results are related to the formation of polarisation films and are in agreement with measurements of cataphoresis of Pt sols and of adsorption at Pt electrodes.

J. A. K.

Mechanism of electro-osmosis in gelatin. J. SWYNGEDAUW (Compt. rend. Soc. Biol., 1938, 129, 569—571).—Electro-osmosis does not vary with the ionic speed for different ions; this is explained by hydration, which is $\gg$ would be expected in dil. solutions of gelatin.

H. G. R.

Capillary systems. XXII. (2) Dialysis potential. E. MANEGOLD and K. KALAUCH (Kolloid-Z., 1939, 86, 186—205).—A review.

E. S. H.

Constitution of iodic acid. III. M. R. NAYAR, L. N. SRIVASTAVA, A. B. SEN, R. GOPAL, and P. N. SHARMA (Z. anorg. Chem., 1939, 240, 217—231; cf. A., 1934, 1305).—Measurements of ρ, η, γ, $[P]$, $[R]$, and Λ for HIO_3 solutions show discontinuities at ~ 0.09N. and 0.04N., which are attributed to de-polymerisation of $(HIO_3)_3$ through $(HIO_3)_2$ to HIO_3. This view is supported by measurements of the Raman spectra of HIO_3 and its salts.

F. J. G.

Vapour pressure and exchange constants of isotopic compounds. H. C. UREY, A. MILLS, I. ROBERTS, H. G. THODE, and J. R. HUFFMAN (J. Chem. Physics, 1939, 7, 138).—By distilling MeOH in a Pegram column for several days [^{18}O] is increased but [^{13}C] is unchanged. The v.p. of $Me^{16}OH$ is $>$ that of $Me^{18}OH$. Refluxing of HCO_2H for $1\frac{1}{2}$ hr. at 30—$35°$ gave no change in [C]. Attempts to secure a separation of isotopes by dissolving a gas in a liquid followed by the methods of exchange reactions proved unsuccessful in the exchange reactions : CO_2–$COMe_2$ (C isotopes); SO_2–$PhNO_2$, SO_2–MeOH, SO_2–H_2O (S isotopes). In HCl–H_2O exchange a slight increase in [^{35}Cl] was effected and [^{13}C] was raised slightly in the C_2H_2–$COMe_2$ exchange. CO exchange with the Cu_2Cl_2–CO complex in aq. NH_3 resulted in deposition of Cu metal and destruction of CO; a similar result was obtained when C_2H_2 was exchanged with the Cu_2Cl_2–C_2H_2 complex in HCl. When CO was exchanged with the Cu_2Cl_2–CO complex in HCl in an 8-m. column, ^{13}C was conc. (max. concn. factor $=$ 1.69) in the liquid phase. ^{34}S was conc. in the gas phase by the exchange of H_2S with NaHS solutions using an 8-m. column. For all distillation and simple solution exchanges the heavy isotope concentrates in the liquid phase rather than in the gas phase.

W. R. A.

Non-coulombic interactions in solutions of electrolytes. C. A. KRAUS (J. Physical Chem., 1939, 43, 231—238).—Non-coulombic interactions in non-aq. solutions of acids and bases, weak salts, salts involving protonic interaction, and salts having ions containing dipoles are briefly discussed. C. R. H.

Thermodynamics of strong electrolytes in protium oxide–deuterium oxide mixtures. I. Hydrogen chloride. E. NOONAN and V. K. LA MER (J. Physical Chem., 1939, 43, 247—258).—The e.m.f. of the cell $H_2|(HCl, DCl)_M$ in $H_2O–D_2O|$ AgCl–Ag has been determined at 25°, and thermodynamic quantities have been evaluated. The free energy change of the process $0.5H_2 + DCl$ (M. in D_2O) $= 0.5D_2 + HCl$ (M. in H_2O) is a function of the D content of the solvent, a max. val. occurring at 75% D_2O. The E^0 val. in D_2O is 0.21792 ± 0.00005 v., or 4.47 mv. $<$ for HCl in H_2O.   C. R. H.

Acid–base equilibria in aqueous and non-aqueous solutions. L. J. MINNICK and M. KILPATRICK (J. Physical Chem., 1939, 43, 259—274).—The relative strengths of carboxylic acids in H_2O, MeOH, EtOH, and H_2O–dioxan mixtures have been measured. From the equilibrium consts. for various acid–base pairs it is shown that $\log K_{A_xB_0}$ is a linear function of $1/\epsilon$, where $K_{A_xB_0}$ is the equilibrium const. for the reaction $A_x + B_0 \rightleftharpoons A_0 + B_x$ (subscripts x and 0 referring to the acid or base in question and the standard acid or base respectively), and ϵ is the dielectric const. Linearity holds only over the range of ϵ 80 to 25. In solvents of the same ϵ the acids have the same relative strength.   C. R. H.

Red coloration of ferric salts with glycine. IV. A. LANGER (Coll. Czech. Chem. Comm., 1939, 11, 5—13; cf. A., 1937, II, 9, 138, 280).—The red colour formed on mixing aq. solutions of $FeCl_3$ and glycine (I) has been investigated by means of ultramicroscope, absorption spectra, potentiometric and conductometric titration, and transport no. measurements. The red colour, which is a true solution, is due to a complex and not to $Fe(OH)_3$ or colloidal basic Fe^{III} chloride. The composition of the complex is confirmed as $FeCl_3,FeCl_2\cdot OH,4(I)$, although the electrical measurements show that the structure of the complex is a very loose one.   D. F. R.

Esterification equilibria in vapour phase. Equilibrium between methyl alcohol, acetic acid, methyl acetate, and water. S. K. K. JATKAR and N. G. GAGENDRAGAD (J. Indian Inst. Sci., 1938, 21, A, 38, 443—448).—The equilibrium const. for the esterification of MeOH by AcOH is greater in the vapour than in the liquid phase. At 260°, using SiO_2 gel as catalyst, 78% conversion occurs; a similar conversion is obtained at 230° using K alum as catalyst and a higher rate of flow of vapour. At 230° with SiO_2 gel, MeOH and EtOH are readily dehydrated to ethers, but with K alum no Me_2O was detected.   F. H.

Influence of ionic strength on protolytic equilibrium and acidity. S. G. TERJESEN and K. SANDVED (Kong. Norske Vidensk. Selsk. Forh., 1937, 10, 109—112).—The problem is discussed on the basis of the Debye–Hückel limiting law for the activity coeff. of ions. It is shown that with increase in ionic strength, the medium protolysis of an acid will increase if the acid is electrically neutral or negatively charged, decrease if the charge z_A is $\ngtr 2$, and not vary if $z_A = 1$. The medium protolysis of a base will increase if the base is neutral or positively charged,

decrease if z_B is $\ngtr -2$, and not vary if $z_B = -1$. If z_B is $\ngtr 0$, the acidity will always increase with ionic strength, and in the special case where $z_B = 0$ the acidity should be nearly independent of salt concn. for bases which react with the medium only to a slight extent.   C. R. H.

Potentiometric investigation of organic bases dissolved in propionic acid. S. G. TERJESEN and K. SANDVED (Kong. Norske Vidensk. Selsk. Skr., 1938, No. 7, 20 pp.).—Potentiometric titrations of org. bases in $EtCO_2H$ containing 1.0 mol. of $LiClO_4$ have been made using a chloranil electrode. $HClO_4$ was used as the titrating acid. $EtCO_2Na$, $NPhEt_2$, and m-$C_6H_4Cl\cdot NH_2$ are stronger bases than NH_2Ac, $CO(NH_2)_2$, $CMe_2:N\cdot OH$, o-$C_6H_4Cl\cdot NH_2$, and $NHPhAc$. The addition of electrolytes diminishes the basicity of the solution, and a base which reacts with the medium to a slight extent at low salt concns. may give quant. formation of solvate ion at higher salt concns.   C. R. H.

Ionisation of acetic acid. H. S. HARNED (J. Physical Chem., 1939, 43, 275—280).—Accurate ionisation consts., K, for AcOH in H_2O, H_2O–MeOH, and H_2O–dioxan mixtures confirm earlier data for the first two solvents. Revised data for the third solvent are recorded. Vals. of K_m and θ have been determined for the equation $\log K_{AcOH} = [\log K_m - p\theta^2] + 2p\theta t - pt^2$, where K_m is the max. val. of K_{AcOH}, θ is the temp. at which K_{AcOH} is a max., t is the temp. in ° c., and $p = 5 \times 10^{-5}$. The average deviation of $\log K_{AcOH}$ from the calc. vals. is 0.002. Vals. for the heat content and capacity and for entropy changes have been calc. The plot of $1/\epsilon$ ($\epsilon =$ dielectric const.) against $\log K_{AcOH} - \log K_0$ (K_0 is the val. of K_{AcOH} in H_2O) is not linear. The extent of the variation of K_{AcOH} is of the same order of magnitude as the variation of K_{H_2O}.   C. R. H.

Dissociation of the ammonium ion and basic strength of ammonia in water. D. H. EVERETT and W. F. K. WYNNE-JONES (Proc. Roy. Soc., 1938, A, 169, 190—204).—The dissociation of NH_4^+ in H_2O has been measured at 10° intervals from 5° to 45°. Vals. of the const. for the equilibrium $NH_3 + H_2O = NH_4^+ + OH^-$ are deduced. The heat of dissociation of NH_4^+ calc. from the temp. coeff. of the dissociation const. is 12,400 g.-cal.   G. D. P.

Dissociation constants of o-, m-, and p-hydroxybenzoic acids, gallic acid, pyrocatechol, resorcinol, quinol, pyrogallol, and phloroglucinol. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, 21, A, 37, 417—441).—K_1 and K_2 for these compounds have been calc. from potentiometric titrations with 0.1N-NaOH at 30°, corrections being made for interionic attraction. K_1 for pyrogallol and phloroglucinol and K_2 for all the compounds are recorded. K_1 for $OH\cdot C_6H_4\cdot CO_2H$ decreases in the order o- $> m$- $> H > p$- and in hydroxybenzenes decreases in the order : $1 : 3 : 5$- $> 1 : 2 : 3$-$C_6H_3(OH)_3$ $> o$- $> m$- $> p$-$C_6H_4(OH)_2$; the order for K_2 in each case is the reverse of that for K_1. The effect on K of distance between ionising groups is shown best in the val. of K_1/K_2. The relation between $\log K_1/K_2$ and the molar absorption coeff. in the infra-red at 7000 cm.$^{-1}$ for the phenols is linear. In pyrocatechol

and pyrogallol the extinction of the band at 7050 cm.$^{-1}$ is accompanied by the appearance of a band at 6970 cm.$^{-1}$ due to the weak OH bond responsible for the increased val. of K_1. F. H.

Dissociation of hydantoin. L. W. PICKETT and M. McLEAN (J. Amer. Chem. Soc., 1939, **61**, 423—425).—Electrometric titration curves or dissociation consts. of hydantoin and 10 related compounds have been determined. In the saturated compounds only the $N_{(3)}$ H dissociates, but in benzylidenehydantoin the $N_{(1)}$ H dissociates to a small extent. E. S. H.

Antagonism between sodium and magnesium ions in their action on oxalate ion. I. GREENWALD (J. Gen. Physiol., 1939, **22**, 385—390).—The action of NaCl on the effect of $MgCl_2$ on oxalate buffer systems (interpreted by Simms as an instance of antagonism of $Na^{\cdot}$ and $Mg^{\cdot\cdot}$) can be formulated as the effect of increasing ionic strength on the dissociation of MgC_2O_4 into $Mg^{\cdot\cdot}$ and C_2O_4''. D. M. N.

Acid–base indicators in methyl alcohol. III. Concentration ionisation constants of indicators and acids in methyl alcohol. I. M. KOLTHOFF and L. S. GUSS (J. Amer. Chem. Soc., 1939, **61**, 330—333; cf. A., 1938, I, 621).—The " concn. ionisation consts." of 32 indicators and acids in MeOH have been evaluated. The variation of these consts. with ionic strength is interpreted in the light of the theory of interionic attraction. E. S. H.

Interpretation of potentiometric titration curves in acid solvents. S. G. TERJESEN and K. SANDVED (Kong. Norske Vidensk. Selsk. Forh., 1937, **10**, 117—120).—Theoretical. Methods have been developed for computing the base strength consts. for different bases dissolved in the same acid. C. R. H.

Activity of hydrogen ions. Y. KAUKO and J. CARLBERG (Soc. Sci. fenn., Comment. phys.-math., 1936, **8**, No. 23, 6 pp.; Chem. Zentr., 1937, i, 799). —The determination of a_H by p_H measurements is discussed. Correction of potentiometric p_H vals. using conductometric dissociation const. data is advocated. Veibel's solution has $p_H = 2\cdot08$, $2\cdot09$ (18—25°, 0°). A. J. E. W.

Conductivity of cadmium monochloroacetate. Activity of the cadmium ion. F. KERTÈSZ (J. Chim. phys., 1938, **35**, 395—406; cf. A., 1939, I, 80). —The conductivity of $(CH_2\cdot CO_2)_2Cd$ solutions has been determined and the activity of $Cd^{\cdot\cdot}$ calc. from e.m.f. measurements. Correcting for the incomplete dissociation of $(CH_2Cl\cdot CO_2)_2Cd$ the laws of ionic interaction are applicable to the dil. solutions. The ionic radius of $Cd^{\cdot\cdot}$ calc. from the results is similar to that found previously in other org. salts of Cd. F. H.

Thermodynamics of aqueous sodium chloride solutions from 0° to 40° from electromotive force measurements. H. S. HARNED and M. A. COOK (J. Amer. Chem. Soc., 1939, **61**, 495—497).—Published work (cf. A., 1932, 467) is re-examined in the light of a more recent technique of calculation. The results are in good agreement with data derived from e.m.f., v.p., f.p., heat of dilution, and sp. heat measurements. E. S. H.

Thermodynamics of bi-univalent electrolytes. IV. Cadmium bromide in aqueous solution. R. G. BATES (J. Amer. Chem. Soc., 1939, **61**, 308—315; cf. A., 1939, I, 80).—E.m.f. of the cell Cd–Hg(2-phase)$|$CdBr$_2$(M.)$|$AgBr–Ag have been measured at 5° intervals from 5° to 40° and from 0·0004M. to 1·8M. The standard potentials of the cell and of the Cd amalgam electrode have been evaluated, and the activity coeffs., relative partial mol. heat content, and relative partial mol. sp. heat of $CdBr_2$ calc. The change of activity coeff. with concn. has been shown to approach the limiting slope of the Debye–Hückel theory above 0·001M. only when a correction for incomplete dissociation of the intermediate cation or ion pair is made. E. S. H.

Phase equilibria in hydrocarbon systems.—See B., 1939, 232.

Heterogeneous equilibrium in binary mixtures with maximum vapour pressure. R. VOGEL (Z. physikal. Chem., 1939, **183**, 340—344).—The theory of Jänecke (A., 1938, I, 450) is discussed. J. W. S.

F.p.–solubility curves of hydrates and other compounds under pressure. L. H. ADAMS (Amer. J. Sci., 1938, [v], **35**, A, 1—18).—The determination of equilibrium curves by measuring the compressibilities of the several phases and applying a simple thermodynamic relation is considered in detail for a no. of systems, and equations used in passing from vol.-change measurements to points on the f.p.-solubility curves are defined. The method is illustrated by the determination of the solubility curve of $Na_2SO_4,10H_2O$ under pressure; other representative types of equilibrium diagrams are discussed. E. S. H.

System calcium sulphate–water. E. POSNJAK (Amer. J. Sci., 1938, [v], **35**, A, 247—272).—Mainly a crit. review of published work. The transition point $CaSO_4,2H_2O \rightarrow \beta\text{-}CaSO_4$ is at $42\pm1°$; that of $CaSO_4,2H_2O \rightarrow CaSO_4,0\cdot5H_2O$ at $97\pm1°$. In the intermediate region $CaSO_4,2H_2O$ is truly metastable. The transition point $CaSO_4,0\cdot5H_2O \rightarrow \gamma\text{-}CaSO_4$ is at a high temp., which has not been determined. A monotropic relation exists between β- and $\gamma\text{-}CaSO_4$. No other solids exist in the system between 0° and 200°. E. S. H.

System water–boron oxide. F. C. KRACEK, G. W. MOREY, and H. E. MERWIN (Amer. J. Sci., 1938, [v], **35**, A, 143—171).—The equilibrium diagram has been determined from solubility measurements. The cryst. phases occurring are ice, H_3BO_3, three *modifications* of HBO_2, and B_2O_3. The modifications of HBO_2 are related monotropically; they melt congruently, the stable form at $236\pm1°$ and the metastable forms at $200\cdot9\pm0\cdot5°$ and $176\cdot0\pm0\cdot2°$, respectively. The corresponding d are $2\cdot486\pm0\cdot003$, $2\cdot044\pm0\cdot003$, and $1\cdot78$. Crystallographic data for the compounds have also been determined. E. S. H.

System water–sodium disilicate. G. W. MOREY and E. INGERSON (Amer. J. Sci., 1938, [v], **35**, A, 217—225).—Apparatus for studying the lowering of m.p. of silicates when heated in steam at high pressures is described. Pressure–temp. relations for solid-

liquid–vapour equilibrium in the system H_2O–$Na_2O,2SiO_2$ have been determined. E. S. H.

Eutectics of ketone–phenol systems and oxonium complex formation.—See A., 1939, II, 161.

Mutual solubility in the system K_2SO_4–H_3BO_3–H_2O. A. P. PEROVA (J. Appl. Chem. Russ., 1938, 11, 1045—1055).—Equilibrium relations have been studied in the system at $-2°$ to $25°$. The solid phases are ice, K_2SO_4, and H_3BO_3, and the lower triple point is at $-2°$ (K_2SO_4 6·6, H_3BO_3 3·1, H_2O 90·3%). With rising temp. the solubility of H_3BO_3 rises relatively faster than that of K_2SO_4. R. T.

System leucite–diopside–silica. J. F. SCHAIRER and N. L. BOWEN (Amer. J. Sci., 1938, [v], 35, A, 289—309).—The equilibrium diagram has been determined. Diopside is almost quantitatively removed by fractional crystallisation, the composition of the residual liquids approaching a mixture of K felspar and SiO_2. E. S. H.

Silicate–water systems : phase equilibria in the $NaAlSi_3O_8$–H_2O and $KAlSi_3O_8$–H_2O systems at high temperatures and pressures. R. W. GORANSON (Amer. J. Sci., 1938, [v], 35, A, 71—91). —Phase equilibria relations have been determined for the systems at 800—$1200°$ at pressures up to 4000 bars. Thermodynamic data, such as apparent vols. and heats of evaporation, have been obtained. The data show that the pressures developed on crystallisation are comparable with those required to explain certain volcanic phenomena. E. S. H.

System $Na_2O,Al_2O_3,2SiO_2$ (nephelite, carnegieite)–$Na_2O,Al_2O_3,6SiO_2$ (albite). J. W. GRIEG and T. F. W. BARTH (Amer. J. Sci., 1938, [v], 35, A, 93—112).—The equilibrium diagram of the system at 1 atm. and 1000—$1526°$ has been determined. E. S. H.

Heats of formation and hydration of ions. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], 6, 382—390). —Further data in support of the author's theories are recorded and discussed (cf. A., 1938, I, 340, 603, 623). C. R. H.

Heat of formation of heavy water. H. FLOOD and L. TRONSTAD (Kong. Norske Vidensk. Selsk. Forh., 1936, 8, 139—142; Chem. Zentr., 1937, i, 295). —The calc. difference of the heats of formation of D_2O and H_2O at $300°$ K. is 1780 g.-cal. The val. determined by combustion of H_2 and 99·5% D_2, corr. for the formation of traces of HOD in the latter case, is 1300 ± 200 g.-cal. A. J. E. W.

Heats of hydrogenation of unsaturated hydrocarbons. J. SHERMAN (Oil and Soap, 1939, 16, 28). —Analysis of figures obtained by Conant and Kistiakowsky (cf. A., 1934, 30; 1935, 304, 825; 1936, 291) shows that the heat of hydrogenation per double linking is nearly const. for compounds containing one or more non-conjugated double linkings, and is less in conjugated than in non-conjugated systems. This effect is most pronounced in aromatic compounds. F. M. F.

Direct measurement of silicate heats of melting. H. S. ROBERTS (Amer. J. Sci., 1938, [v], 35, A, 273—287).—Apparatus and procedure for measuring the energy absorbed by silicates on melting are described. Preliminary results have been obtained for K_2SO_4 and Na_2SiO_3. E. S. H.

Micro-calorimeter. Heats of dilution of aqueous solutions of sucrose at $20°$ and $30°$ and their heat capacities at $25°$. F. T. GUCKER, jun., H. B. PICKARD, and R. W. PLANCK (J. Amer. Chem. Soc., 1939, 61, 459—470).—Apparatus sensitive to 1 microdegree is described. The heat of dilution of sucrose from 0·005M. to 0·2M. at $20°$ and from 0·0001M. to 0·2M. at $30°$ is a linear function of M. The apparent mol. heat capacity is also a linear function of M. By combining the results with published data for more conc. solutions, equations have been obtained for the apparent and partial mol. relative heat contents and heat capacities of sucrose and of H_2O in these solutions. E. S. H.

Heats of dissolution and of dilution of the binary systems zinc nitrate–water and cadmium nitrate–water. W. W. EWING, J. D. BRANDNER, and W. R. F. GUYER (J. Amer. Chem. Soc., 1939, 61, 260—265).—Data for the anhyd. salts and their hydrates at $25°$ are recorded. The prep. of $Zn(NO_3)_2$ from ZnO and N_2O_5 is described. E. S. H.

Entropies of aqueous zinc and cadmium ions. Heat capacity of zinc ion. R. G. BATES (J. Amer. Chem. Soc., 1939, 61, 522—523).—The entropies at $25°$ calc. from e.m.f. and other data are : $Zn^{··}$ $-25·89$, $Cd^{··}$ $-14·82$ g.-cal. per degree per mol. The heat capacity of $Zn^{··}$ is $-9·32$ at $25°$. E. S. H.

Metallic conductivity.—See B., 1939, 278.

Passage of an [electric] current in copper iodide. P. VAILLANT (Compt. rend., 1939, 208, 32—34).—A CuI cell has been constructed from two Cu strips dipping to ~2 cm. in CuI and rigidly connected below the surface by two ebonite plates. The conductance $c \propto$ intensity of current i, duration of passage t, and temp. θ. At const. temp. and for currents <20 ma., c is const. (c_0) and varies with temp. according to an exponential law. For currents >20 ma. c increases with increasing t at const. temp. reaching a limit c_2, which is expressed by $c_2 = c_0 + ai$, where a is a coeff. independent of θ. The variation with t for a given i is most rapid when the current is most intense and the temp. very low. W. R. A.

Conductance of salts in tricresyl phosphate at $40°$. M. A. ELLIOTT [with R. M. FUOSS] (J. Amer. Chem. Soc., 1939, 61, 294—299).—Data for NBu_4 (I), $NHBu_3$ (II), $NH(CH_2Ph)_3$, p-$C_6H_4Ph·NH_2$, $NPhMe_2$, and NH_2Ph picrates, and Pb abietate (III) at $40°$ and 60 cycles are recorded. (I) and (II) give almost normal conductance curves; the curves for the aromatic amine picrates and (III) suggest that these substances exist in two modifications, one of which cannot furnish ions. E. S. H.

Ion conductances in water–methanol mixtures. L. G. LONGSWORTH and D. A. MACINNES (J. Physical Chem., 1939, 43, 239—246).—Transference and conductivity (λ) data at $25°$ for 0·05N-NaCl and -LiCl in H_2O–MeOH mixtures and η data for the solvents have been obtained. Walden's rule, $\lambda_0\eta =$ const., is not obeyed, $\lambda_0\eta$ decreasing rapidly with in-

crease in [MeOH], indicating that ion–solvent complexes increase in size with increase in [MeOH]. In a given solvent, $\lambda_{Cl'}$ is approx. the same for both salts. C. R. H.

Free energy of hydration of gaseous ions, and the absolute potential of the normal calomel electrode. W. M. LATIMER, K. S. PITZER, and C. M. SLANSKY (J. Chem. Physics, 1939, **7**, 108—111). —The free energies of hydration of alkali and halide ions agree satisfactorily with the vals. calc. by the simple expression of Born for dissolution of charged spheres in a dielectric medium, if the crystal radii are corr. so as to correspond with the radii of the cavities in the dielectric medium. The entropies of hydration are also consistent with these radii. The abs. potential of the normal calomel half-cell, calc. from the free energies of dissolution of the individual ions, is −0·50 v. W. R. A.

Single metal reversion cell. A. P. SERGEEV and A. N. JAVORSKI (Mem. Phys. Ukrain., 1937, **6**, 97—102).—The cell Sn|SnCl₂,HCl|NaOH|Sn has an e.m.f. of 0·5—0·6 v. and supplies a current for many hr. J. J. B.

Oxidation–reduction potentials of substituted quinoneanils and indoanilines.—See A., 1939, II, 167.

Oxidation–reduction equilibrium in the system diaminocozymase–alcohol apodehydrogenase–alcohol.—See A., 1939, III, 424.

Capacity of the mercury electrode in solutions of capillary-active substances. A. KSENOFONTOV, M. PROSKURNIN, and A. GORODETZKAJA (Acta Physicochim. U.R.S.S., 1938, **9**, 39—44).—A physical interpretation is given of the shape of the curves of the Hg electrode capacity in Bu^{a}OH, Bu^{a}OH + Na₂SO₄, and PhOH + Na₂SO₄. W. R. A.

Capacity of the solid mercury electrode. A. GORODETZKAJA and M. PROSKURNIN (Acta. Physicochim. U.R.S.S., 1938, **9**, 45—50).—Both the capacity per sq. cm. of true surface area and the surface area of Hg remain nearly unaltered on freezing as indicated by measurements of the capacity of solid and liquid Hg in aq. K₂CO₃ and aq. K₂CO₃ saturated with EtOH. W. R. A.

Maxima on current–voltage curves. B. BRUNS, A. FRUMKIN, S. JOFA, L. VANJUKOVA, and S. ZOLOTAREVSKAJA (Acta Physicochim. U.R.S.S., 1938, **9**, 359—372; cf. A., 1934, 1079).—Current–voltage curves at a Hg cathode in solutions of Hg₂(NO₃)₂ under various conditions have been measured. A theory is outlined which attributes the max. on the current–voltage curve to the "auto-stirring" caused by the movements of the Hg surface, which are related to local differences of interfacial tension or to variations of this tension with time. A method of measuring the potential of a Hg cathode at different points in the surface is described. O. J. W.

Kinetics of electrode reactions. I, II. J. N. AGAR and F. P. BOWDEN (Proc. Roy. Soc., 1938, **A, 169**, 206—234).—I. A theory is developed showing how the overpotential depends on c.d., concn., and temp. The resistance of the diffusion layer may attain high vals.

II. Measurements of the O overpotential on Ni and Pt electrodes in fused NaOH indicate that the overpotential is due to change of [H₂O] in the melt in the immediate vicinity of the electrode. The general behaviour is consistent with the theory of Part I. G. D. P.

Polarisation of quinhydrone electrodes. V. ČUPR (Coll. Czech. Chem. Comm., 1939, **11**, 14—27). —A relation between the polarisation of the quinhydrone electrode and the current intensity, internal resistance, and size of electrode has been derived, starting from Fick's first law of diffusion. By using a photographic recording apparatus for measuring the change of depolarisation with time, an attempt has been made to verify experimentally Fick's second law of diffusion. In both cases, the existence of local cells on the electrodes prevented close agreement between theoretical and experimental results. D. F. R.

Passivity and corrosion of metals. W. J. MÜLLER (Kolloid-Z., 1939, **86**, 150—166).—A summary of published work. E. S. H.

Rates of unimolecular reactions in gases. N. B. SLATER (Proc. Camb. Phil. Soc., 1939, **35**, 56—69).—Theoretical. The homogeneous dissociation of a uniform gas, in which the mol. is treated as a dynamical system with n normal modes of vibration with incommensurable frequencies, results in a velocity coeff. of the form average frequency $\times e^{-W/RT}$. F. J. L.

Reaction velocity of mixtures. I. Bimolecular reactions of two mixed substances with a third substance. J. G. VAN DER CORPUT and H. J. BACKER (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 1058—1073).—Mathematical. W. R. A.

Mechanism of detonating processes. W. JOST (Z. physikal. Chem., 1939, **42, B**, 136—142).—Two difficulties appear in the theory of detonation concerning (i) the stability of the detonating wave, and (ii) the maintenance of detonation at the requisite reaction velocity. Simultaneous consideration of (i) and (ii) leads to a description of the so-called "spins" of detonation. W. R. A.

Theory of thermal propagation of flame. J. B. ZELDOVITSCH and D. A. FRANK-KAMENETZKI (J. Phys. Chem. Russ., 1938, **12**, 100—105).—Consideration of diffusion and heat conduction in a flame lead to the expression $(T - T_0)/(T_1 - T_0) = (a - a_0)/(a_1 - a_0) = (b - b_0)/(b_1 - b_0) \ldots$, where T, a, $b \ldots$ are the temp. and concn. in a point of the flame, T_1 is theoretical temp. of combustion, $a_0, b_0 \ldots$ $a_1, b_1 \ldots$ concns. before and after the reaction, respectively, and T_0 the temp. before the reaction. J. J. B.

Ignition of gases by local sources. II. Ellipsoid sources. H. G. LANDAU (J. Chem. Physics, 1939, **7**, 112—115).—The theory of ignition of gases given previously (Chem. Rev., 1937, **21**, 245) for spherical sources is extended to ellipsoid sources, with the sphere and infinite cylinder as special cases. For cylindrical sources ignition can occur without chain branching and without thermal self-acceleration of the medium. W. R. A.

Amorphous state. XV. Mechanism of polymerisation. XVI. Case of polymerisation. F. MAREI (Acta Physicochim. U.R.S.S., 1938, **9**, 741—758, 759—766).—XV. Theoretical. The activation of monomeric mols. is the initial process in polymerisation. The velocity of activation is greatest at the beginning. The velocity of chain rupture has min. vals. at the beginning and at the end, the probability of rupture having its max. at a definite stage of polymerisation. The greatest no. of mols. at any stage of polymerisation corresponds with a dimeride, the no. of polymeric mols. being the smaller the higher is their mol. wt.

XVI. Mathematical. A scheme proposed by Schulz (cf. A., 1936, 295) for explaining the autocatalytic character of polymerisations is criticised.

C. R. H.

Kinetics of the slow oxidation of hydrogen. E. J. NEUMARK, L. P. KULASHINA, and M. V. POLJAKOV (Acta Physicochim. U.R.S.S., 1938, **9**, 733—740).—At low pressures ($\sim$ 12 mm. Hg) and temp. ($\sim$320°) the reaction, catalysed by Pt, is a heterogeneous surface reaction, the reaction rate increasing proportionally to the increase in the surface area of the Pt. At higher temp. (360—405°) the presence of a vol. reaction is indicated. With the reaction vessel filled with quartz fragments, however, the presence of a vol. reaction is doubtful since the velocity coeffs. are consistent with the reaction being solely a surface one even at 405°. Above 405° and at 92 mm. Hg the vol. reaction is predominant, the rate being only slightly dependent on the surface area of the Pt. The data suggest that not only the vol. process but also the surface process has a chain character.

C. R. H.

Thermal hydrogen–chlorine reaction. I. Experimental kinetics. II. Relation to the theory of chain reactions. J. C. MORRIS and R. N. PEASE (J. Amer. Chem. Soc., 1939, **61**, 391—396, 396—401). I. The rate of reaction depends on the type of vessel used and decreases as the reaction proceeds. The kinetics in a Pyrex vessel can be expressed by $d\frac{1}{2}[HCl]/dt = k_A[H_2]^2[Cl_2]/\frac{1}{2}HCl$; the expression for the reaction in Pyrex coated with KCl is $d\frac{1}{2}[HCl]/dt = k_B[H_2][Cl_2]^{\frac{1}{2}}$.

II. The above kinetic data can be explained by treating the reaction as a Nernst chain, starting at the walls by dissociation of Cl_2 and ending by reversal of the process. The chain length in the thermal reaction at 200° is calc. to be about 10^4, which is compared with 10^6 in the photochemical reaction at room temp., thus explaining the slight inhibition of the thermal reaction by O_2 compared with the retardation in the photochemical reaction.

E. S. H.

Incomplete combustion of methane. P. H. DEGENS, jun. (Rec. trav. chim., 1939, **58**, 39—57).—The combustion of CH_4 has been studied by leading it, mixed with air, through a SiO_2 capillary (no catalyst) at 700°, and analysing the products. Parallel experiments on the decomp. and on the combustion of MeOH, CH_2O, and HCO_2H at 600—800° were also undertaken with a view of identifying one or more as intermediate products. MeOH shows very slight decomp., but complete oxidation,

at 700°, whilst CH_2O, which is readily oxidised at 600°, is only 37% decomposed at 800°. It is inferred that in the oxidation of both these substances a large local rise of temp. occurs, and that the oxidation of CH_4 under similar conditions is due to thermal induction. This view is supported by experiments in which the addition of MeOH or CH_2O to CH_4–air mixtures resulted in more complete oxidation of the CH_4 at 700° than at 800° without the admixture.

F. L. U.

Kinetics of slow combustion of methane at low pressures. M. V. POLJAKOV and A. V. KORNEIEVA (Acta Physicochim. U.R.S.S., 1938, **9**, 186—196).—The effect of metal surfaces (Pt wire) on the kinetics of the slow oxidation of CH_4 has been studied at pressures < the lower ignition limit and between 400° and 700°. Increase of the length of Pt wire gives a growth of the induction period and a decrease in the reaction rate at 700°, indicating that the vol. chain process predominates. At 400°, however, the induction period is a min. and the reaction rate is a max. when the Pt surface is a max., indicating the predominance of the surface reaction. The data show that (i) the two types of reactions constitute a case of homogeneous–heterogeneous catalysis, (ii) the initiation of the vol. reaction is a surface process, and (iii) the vol. reaction is a chain reaction, and so possibly is the heterogeneous process. W. R. A.

Auto-inflammation of gaseous mixtures at short [time] lags. II. Mixtures of pentane with air. W. STERN, B. KRAVETZ, and A. SOKOLIK (Acta Physicochim. U.R.S.S., 1938, **9**, 141—162, and J. Phys. Chem. Russ., 1938, **12**, 69—80; cf. A., 1939, I, 30).—The auto-inflammation of C_5H_{12}–air mixtures has been studied as a function of composition (2·2—4·7% C_5H_{12}), temp., and pressure. Between 330° and 380° (lower limit of inflammation zone) the temp. coeff. A of the Semenov equation is $\leqslant 0$. At 380° to 480° A increases continuously, and at high temp. A attains a const. val. $\sim$ 3000. In the inflammation zone the lag, τ, is independent of the pressure at lower temp. (<380°) whereas the temp. has a notable influence, whilst at higher temp. τ is independent of temp. but $\propto 1/p^3$. The results are discussed in relation to the detonation and auto-inflammation in the combustion engine. W. R. A.

Mechanism of the formation of peroxide and aldehyde in explosive oxidation of ethylene. M. V. POLJAKOV and F. M. WEINSTEIN (J. Phys. Chem. Russ., 1938, **12**, 137—139; cf. A., 1937, I, 250).—The yield of peroxide $\propto p^{-2}$ (p = pressure) and decreases with increasing temp. of the walls of the reaction vessel. Presumably the peroxide is formed on the cooled walls only and the aldehyde is a product of its decomp. J. J. B.

Hydrogen chloride–propylene reaction in the region of the critical temperature. C. H. HOLDER and O. MAASS (Canad. J. Res., 1938, **16**, B, 453—467; cf. A., 1931, 1239).—The reaction between HCl and C_3H_6 has been studied in the liquid state just below the crit. temp. and in the gaseous state just above the crit. temp. at densities comparable with that of the liquid. In the liquid state the temp.

coeff. is negative in a range of 25° below the crit. temp., and in this range ρ decreases rapidly with rising temp. In the gaseous state the rate is very small for low vals. of ρ, but increases slowly as ρ increases up to a crit. val. which is of the same order as ρ for the liquid, and then the rate increases rapidly with further increase in ρ. The results are discussed in terms of the hypothesis that a structure characteristic of the liquid state favours a high reaction rate, and that such a structure may exist above the crit. temp. at sufficiently high densities.
                                                    F. J. G.

Combustion of mixtures of hydrocarbons. Mixtures of deca- and tetra-hydronaphthalene. P. DUMANOIS, G. RETENAUER, and M. PRETTRE (Compt. rend., 1939, **208**, 351—353).—Composition limits for inflammation at <300° of tetralin–decalin–O_2–N_2 mixtures have been determined using fuels containing the following mol.-fractions of decalin: 0·1, 0·25, 0·50, 0·75, and 0·9. The limits, which are plotted on a triangular diagram, show that the reaction chains are initiated only by decalin, but both decalin and tetralin are responsible for their propagation.   A. J. E. W.

Inflammation of mixtures of air with diethyl ether and with various hydrocarbons at reduced pressures. Green flames. M. S. HSIEH and D. T. A. TOWNEND (J.C.S., 1939, 332—337; cf. A., 1937, I, 313).—Inflammation of Et_2O–air mixtures containing 5—8% Et_2O gives rise to green flames at reduced pressures. The pressure limit below which green flames are observed is 400 mm. at 20°, 300 mm. at 100°, and 240 mm. at 150°. Green flames are also observed in the ignition of mixtures of simple hydrocarbons and air of suitable composition, the range of pressure over which the phenomenon is observed decreasing in the order: Et_2O–air > C_6H_{14}–air > C_5H_{12}–air > CH_4–air. The green flames are due to the Swan bands arising from excited C_2 mols. emitting at 4381 and 4737 A., which dominate the visible emission when the O_2 present is < the amount theoretically required for complete combustion.
                                                    F. H.

Examination of the mechanism by which "cool" flames may give rise to "normal" flames. I. Inflammable ranges of ether–air mixtures in closed vessels. II. Inflammable ranges of higher paraffin hydrocarbons in air: establishment of "cool" flame ranges at ordinary temperatures and high pressures. M. S. HSIEH and D. T. A. TOWNEND (J.C.S., 1939, 337—340, 341—345; cf. preceding abstract).—I. Comparison of the influence of pressure on the composition ranges of Et_2O–air mixtures which when artificially ignited at 20°, 50°, 100°, and 150° and spontaneously ignited at 200° lead to initiation of cool flames and to the setting up of normal flames in the products of the cool flames indicates that the same processes are involved in the production of cool flames and in the setting up of normal flames whether the mixtures are artificially or spontaneously ignited. At low temp. the mixtures at the min. ignition pressures contain 17—30% Et_2O but at 200° the min. ignition pressure is the same for mixtures containing

17—70% Et_2O. Cool flame pulses are detectable at 300 mm. in mixtures containing ≯98% Et_2O.
II. The influences of pressure on the inflammable ranges for artificially ignited mixtures of C_6H_{14}–air, C_6H_{14}–O_2, C_4H_{10}–air, and C_3H_8–air are recorded. The min. pressures and the time lags for spontaneously developed cool flames are > those for Et_2O–air. The cool flame ranges are located at progressively decreasing initial pressures as the paraffin series is ascended, being at 100°: Et_2O, <1 atm.; C_6H_{14}, >5 atm., C_4H_{10} >9 atm.; C_3H_8, >12 atm.   F. H.

Hydrogen exchange in aqueous solutions of acetic acid and acetates. L. D. C. BOK and K. H. GEIB (Z. physikal. Chem., 1939, **183**, 353—370; cf. A., 1938, I, 580; II, 169).—A detailed report of results previously recorded.   J. W. S.

Decomposition of deutero-oxalic acid in heavy water. E. SCHRÖER (Z. physikal. Chem., 1939, **183**, 392—396).—The velocity of decomp. of $D_2C_2O_4$ in D_2O at 136—152° is ~20% > that of $H_2C_2O_4$ in H_2O at the same temp. (A., 1937, I, 622). This may be due to depression of the C–C frequency by the presence of D, difference in the contribution of the zero-point energy in the two cases, or differences in the ease of separation of D and H linkages. J. W. S.

Velocity of hydrolysis of nitrous esters. A. SKRABAL, A. ZAHORKA, and K. WEIMANN (Z. physikal. Chem., 1939, **183**, 345—352).—The velocity of hydrolysis of $MeONO$, $EtONO$, $Pr^\beta ONO$, and $Bu^\gamma ONO$ in acid solution ∝ [ester][H·]. In alkaline solution the reaction appears to be a combination of a bimol. reaction of the ester with OH′ and a pseudo-unimol. H_2O hydrolysis. The numerical results obtained were not in accord with those of Fischer and Schmidt (A., 1929, 667).   J. W. S.

Emulsification and chemical reaction. A. KING and L. N. MUKERJEE (J.S.C.I., 1938, **57**, 431—433).—The rate of hydrolysis of amyl acetate emulsions by alkali has been studied, using different emulsifying agents. Size frequency analyses of the emulsions were made. Although the rate of hydrolysis is always greater in the emulsified than in the unemulsified system, the rate per unit area of interface is greatest when there is no agent and varies considerably with the emulsifying agent used. The nitration of C_6H_6 emulsions and prep. of $CH_2Ph·OH$ from CH_2PhCl emulsions were also studied; yields obtained were better than when the reactants were unemulsified.

Ether-like compounds. II. Acid hydrolysis of ether-lactones having a five-ring. E. J. SALMI (Ber., 1939, **72**, [B], 319—326).—The rates of acid hydrolysis of a no. of esters of α-OH-acids are compared with those of the corresponding n-alkyl esters. The ring-formation has little or no effect on the rate of hydrolysis, except in the case of the α-hydroxyisovaleric esters, where the "effect of chain-branching brought out by further substitution" appears. This effect is illustrated by a comparison of the rates of hydrolysis of the esters of the α-OH-acids and those of the fatty acids; the rates are similar except when the chain branches in the α- or β-positions. Again, the rates of hydrolysis of esters

$R\cdot[CH_2]_2\cdot CO_2Me$ differ only slightly from those of esters $R\cdot O\cdot CH_2\cdot CO_2Me$. The mechanism of hydrolysis and the peculiarities of *tert.*-alkoxy-compounds are discussed. F. J. G.

Calculation of rates of hydrolysis from constitutional formulæ. A. SKRABAL (Ber., 1939, **72**, [*B*], 446—452).—The rate of hydrolysis of a compound XOY might be regarded as determined by factors characteristic of the products XOH and YOH. If so the rate for XOY would be the geometric mean of the rates for X_2O and Y_2O. This view is an approximation, valid in certain limiting cases. A more general theory would regard the rate of hydrolysis as dependent on a factor characteristic of each radical and another representing the influence of each radical on the other. Deductions from the theory are discussed and compared with observation.
  F. J. G.

Rate of the haloform reaction. Effect of the nature of the halogens. L. H. SUTHERLAND and J. G. ASTON (J. Amer. Chem. Soc., 1939, **61**, 241—244).—Formation of $CHClBr_2$ from $CClBr_2\cdot CO_2H$ in H_2O and EtOH is a first-order reaction, the energy of activation being 32,000 g.-cal. in H_2O and 39,000 g.-cal. in EtOH. Similar formation of $CHClBrF$ is influenced by OH′ and its rate cannot be interpreted. The kinetics are discussed. R. S. C.

Reversibility of the glycerophosphoric change. (MLLE.) M. C. BAILLY (Compt. rend., 1939, **208**, 443—445; cf. A., 1938, II, 353).—The conversion of Na β- into α-glycerophosphate and the reverse reaction by boiling dil. H_2SO_4 are unimol. reactions in which the velocity coeffs. of the β→α and α→β reactions are 0·0426 and 0·0064, respectively. At the completion of hydrolysis about 10% of the β-ester is isolated as its double salt with $Ba(NO_3)_2$ (cf. A., 1926, 384). J. L. D.

Kinetics of the reactions of ethyl iodide with bases in ethyl alcohol–water mixtures. S. EAGLE and J. C. WARNER (J. Amer. Chem. Soc., 1939, **61**, 488—495).—The rates of reaction of EtI with NaOH, NEt_3, NaOAc, $LiNO_3$, and the solvent, in EtOH–H_2O mixtures, have been measured at 25° and 50°. The calc. velocity coeffs. have been correlated with modern acid–base theories. An explanation of the dilution effect is suggested. NO_3′ appears to react directly with EtI, so that the influence of $LiNO_3$ is not primarily inert salt catalysis. Approx. vals. of the energies of activation for the above reactions have been calc. E. S. H.

Spectrophotometric study of the slow hydrolysis of ferric salts. J. CATHALA and J. CLUZEL (Compt. rend., 1939, **208**, 186—188; cf. A., 1939, I, 85).—Curves illustrating the effect of p_H (4·7—6·0) on the rate of hydrolysis of 0·0005—0·01N-$Fe(NO_3)_3$ are given. A. J. E. W.

Oxygen exchange between carbon dioxide, hydrogen carbonate ion, carbonate ion, and water. G. A. MILLS and H. C. UREY (J. Amer. Chem. Soc., 1939, **61**, 534).—The rate of exchange of ^{18}O between CO_2 and H_2O has been determined; there is no salt effect with NaCl in H· catalysis with HCl. The exchange of ^{18}O between HCO_3′ and H_2O

takes place through the formation of H_2CO_3 and CO_2. Between CO_3″ and H_2O exchange proceeds through the formation of HCO_3′. E. S. H.

Kinetic study of the Friedel–Crafts benzophenone synthesis. H. ULICH and P. VON FRAGSTEIN (Ber., 1939, **72**, [*B*], 620—628).—Starting from $BzCl,AlCl_3$ the reaction was carried out at 30° and followed by measuring the evolved HCl at const. pressure (cf. A., 1935, 1207). Earlier work by Steele (J.C.S., 1903, **83**, 1470) and Olivier (A., 1936, 297) is confirmed. Solid $AlCl_3$ in excess of that necessary for forming $BzCl,AlCl_3$ catalyses the reaction, which is still further promoted by HCl. When enough $BzCl,AlCl_3$ and solid $AlCl_3$ are present the reaction becomes of zero order. F. L. U.

Kinetics of wetting and the linear-selective corrosion of metals in polyphase systems. D. I. MIRLIS and A. I. GLUCHOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 35—39).—The influence of H_2S on the corrosion of Fe in the polyphase system Fe–H_2O–benzine is investigated in each phase and at the interfaces. In the presence of H_2S the corrosion is most rapid in the benzine phase and least at the interface. During the corrosion droplets of H_2O form on the Fe in the benzine phase and are absorbed by it, thickening the sulphide film. The rate of hydrophilisation of the Fe surface was determined by measuring the angle of wetting with time; it decreases from 109° to 90° in 24 hr. in absence of H_2S and from 88° to 46° using a saturated solution of H_2S. F. J. L.

Rate of formation and dissociation of calcium hydride. W. C. JOHNSON, M. F. STUBBS, A. E. SIDWELL, and A. PECHUKAS (J. Amer. Chem. Soc., 1939, **61**, 318—329).—Conditions for the prep. of pure Ca and of CaH_2 by direct action at 230—270° are described. The rate of reaction between H_2 and the active form of Ca obtained from liquid NH_3 solution $\propto$ the pressure of H_2; the heat of activation is 7700±500 g.-cal. per mol. Experiments at 640—894° show that CaH_2 has a much higher dissociation pressure than partly hydrogenated Ca. Evidence of the formation of solid solutions of Ca in CaH_2 and of CaH_2 in Ca has been obtained, but no support for the existence of a subhydride of Ca is offered.
  E. S. H.

Oxidation of sulphides in oxygen-enriched air. N. P. DIEV and J. V. KARJAKIN (J. Appl. Chem. Russ., 1938, **11**, 1112—1122).—At 500° the velocities of desulphuration and of oxidation of FeS are independent of the $[O_2]$, whilst at 700—1100° the process is 1·6—2·2 times as rapid in air containing 40—60% of O_2 as in ordinary air. R. T.

Action of carbon dioxide on the auto-inflammability of a hexane–air mixture. W. STERN, B. KRAVETZ, and A. SOKOLIK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 40—41).—The addition of CO_2 to an air–C_6H_{14} mixture retards the combustion. 0·1% CO_2 raises the temp. of auto-inflammability from 340° to 550°. F. J. L.

Influence of admixtures on the induction period of cold and hot flames in butane. B. V. AIVAZOV, M. B. NEUMANN, and I. I. CHANOVA (Acta

Physicochim. U.R.S.S., 1938, **9**, 767—794).—The induction period of a cold flame, t_1, in C_4H_{10}–O_2 mixtures depends on temp. and pressure according to $t_1(p - p_0)^{1\cdot2}e^{-22,000/T} = $ const., p_0 denoting the min. pressure at which the cold flame appears. t_1 is reduced by addition of H_2, CO_2, Et_2O, and Pr^β_2O. H_2, CO_2, and Pr^β_2O also increase the induction period of the hot flame, t_2, but Et_2O reduces t_2. At low temp. H_2 and Pr^β_2O retard and at high temp. accelerate the appearance of the hot and cold flames. CO_2 reduces the region of the hot flame at all temp., but the region of the cold flame is widened at low and narrowed at high temp. Et_2O displaces the regions of hot and cold flames in the directions of low temp. and pressures. A method of calculating the influence of inert gases on t_1 has been developed. For H_2 and CO_2 $t_1 \sim 0\cdot9t_0$ where t_0 is the induction period in absence of inert gas. The data are discussed.

C. R. H.

Anti-oxygen effects from the point of view of the electron ratio rule. P. CARRÉ and L. PEIGNÉ (Compt. rend., 1939, **208**, 108—109).—$POCl_3$ inhibits oxidation reactions more effectively than CCl_4 owing to the higher polarity of the P–O linking, which results in a greater affinity for O_2 mols. $CSCl_2$ inhibits oxidation of PhCHO more strongly than $COCl_2$, the C–S linking being more polar than C–O.

A. J. E. W.

Acid and base catalysis in light and heavy water. II. Hydrolysis and deuterium exchange of acetamide and acetonitrile. O. REITZ (Z. physikal. Chem., 1939, **183**, 371—396; cf. A., 1937, 1, 469).—In $0\cdot1$N-HCl at 25° the velocity of hydrolysis of NH_2Ac in D_2O is ~50% > in H_2O, in $2\cdot3$N-HCl the velocities are equal, and in 3—4N-HCl the reaction in D_2O is slower than in H_2O. It is suggested that the total reaction velocity $\propto$ the product of the concn. of the additive complex of NH_2Ac with the catalysing ions and its velocity of decomp. At low catalyst concn. the concn. of complex in D_2O is > in H_2O, yielding a higher reaction velocity, but at higher acid concn. almost all the NH_2Ac mols. are held as complex, and so the lower velocity of decomp. of the complex in D_2O becomes the controlling factor. The hydrolysis of MeCN in acid D_2O at ~100° is 35% > in H_2O. In alkaline D_2O, hydrolysis of NH_2Ac at 25° and of MeCN at 35° is 10% slower and 20% more rapid, respectively, than in H_2O at the same temp. During acid hydrolysis no exchange of D with the Me group is observed, but in alkaline solution the velocity of such change is ~50% of the velocity of hydrolysis for NH_2Ac and 30—40 times the velocity of hydrolysis for MeCN.

J. W. S.

Kinetics of the catalysed esterification of normal aliphatic acids in methyl alcohol. H. A. SMITH (J. Amer. Chem. Soc., 1939, **61**, 254—260).—The kinetics of reaction have been studied for formic, acetic, propionic, butyric, valeric, n-hexoic, and n-nonoic acids; the activation energy is 10,000 g.-cal. per mol. in each case; the rate coeffs. have been determined. The influence of the length of the C chain of the acid on the rate of esterification is due almost entirely to the s factor in the equation $k = sZe^{-E/RT}$. The variation is explained by assuming

that the C chain of the lower acids tends to have a ring rather than a straight chain structure.

E. S. H.

Ether-like compounds. XXI. Acid ester- and ether-hydrolysis of the dialkyl carbonates. M. H. PALOMAA, E. J. SALMI, and K. SUOJA (Ber., 1939, **72**, [B], 313—317).—The temp. coeffs. (k^{35}/k^{25}) of the velocities of acid-catalysed hydrolysis in aq. dioxan (50 vol.-%) of $CO(OEt)\cdot OBu^\gamma$ and $CO(OPr^a)\cdot OBu^\gamma$ are $3\cdot9$ and $3\cdot6$, respectively, so that the reactions are ether-hydrolyses. In the acid hydrolysis of $EtOBu^\gamma$ under the same conditions $k^{25}/k^{35} = 4\cdot0$. The *compounds* $CO(OMe)\cdot OPr^\beta$, b.p. $115\cdot6$—$116\cdot4°/757$ mm., $CO(OPr^a)\cdot OPr^\beta$, b.p. $155\cdot2$—$155\cdot6°/758$ mm., $CO(OEt)\cdot OBu^\gamma$, b.p. $23\cdot8$—$24\cdot4°/1$—2 mm., and $CO(OPr^a)\cdot OBu^\gamma$, b.p. $58\cdot0$—$59\cdot0°/12$—13 mm., are described. Physical data for a no. of other dialkyl carbonates are recorded. F. J. G.

Influence of substituents on additive reactivity of ethylene derivatives. IV. Mechanism of reaction. S. V. ANANTAKRISHNAN and R. VENKATARAMAN (J.C.S., 1939, 224—229; cf. A., 1935, 1465).—The effects of concn. and of ICl, HBr, and $SbBr_3$ as catalysts on the rate of addition of Br to *trans*-crotonic acid and to tiglic acid in solutions in AcOH are studied. The period of induction of the reaction increases with dilution of the reagents and may be eliminated by the use of ICl and HBr as catalysts. The reaction becomes bimol. only when the concn. of catalyst is $7\cdot5$ mol.-% of olefine and under these conditions comparison of additive reactivities by a competitive method is possible. The addition of Br to olefine is not a simple bimol. or termol. reaction and is explained by a chain mechanism : (i) $CH_2{:}CH_2 + Br_2 \to CH_2{:}CHBr + HBr$; (ii)

$$CH_2{:}CH_2 + HBr \to \begin{matrix} CH_2=CH_2 \\ | \quad\quad | \\ H\text{——}Br \end{matrix} \text{(I)} ; \text{(iii)} \quad Br_2 + HBr$$
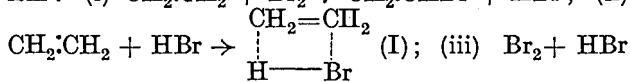
$\to Br_2{*} + HBr$; (iv) (I) $+ Br_2{*} \to CH_2Br\cdot\overset{\oplus}{C}H_2 + HBr + Br^-$; (v) $CH_2Br\cdot\overset{\oplus}{C}H\cdot + Br^- \to CH_2Br\cdot CH_2Br$. (i) accounts for the initial formation of small amounts of HBr ; (iii) explains the rôle of HBr as activator ; (iv) is the rate-determining reaction in presence of catalyst ; HBr liberated in (i) and (iv) again takes part, the chain being repeated. The fall in the rate of reaction with time after a certain limit and the anomalous behaviour of the negative catalyst, $SbBr_3$, are discussed. F. H.

Reactions in concentrated sulphuric acid. XIII. Mannitol, a negative catalyst of reactions in concentrated sulphuric acid. J. MILBAUER (Chem. Obzor, 1938, **13**, 225—228).—Mannitol, even in concns. as low as 1 : 10,000, retards the rate of oxidation of H_2, $FeSO_4$, KCNS, and $CS(NH_2)_2$ in conc. H_2SO_4, in so far as it is not oxidised itself, but has no action with CO, which nullifies its effect. Sorbitol does not show these reactions. F. R.

Inhibitory action of sulphite and other compounds in autoxidation of quinol and its homologues.—See A., 1939, II, 153.

Simple molecular mechanism for heterogeneous catalytic reactions. E. K. RIDEAL (Proc.

Camb. Phil. Soc., 1939, **35**, 130—132).—A simple mol. mechanism of catalytic action involving H_2 at metallio surfaces is put forward. Two assumptions are made: (i) the surface catalytic reactions take place between a chemisorbed atom or radical, usually maintained by a covalent linkage, and a mol. which is derived either by direct impact from the gas phase or is held in a relatively deep van der Waals trough above and between the constituents of the chemisorbed layer; (ii) the mechanism of interaction between the two species is such that the covalent link between the chemi-adsorbed constituent and the substrate either is not broken, or if it is, an exchange takes place such that it is converted into a van der Waals bond and simultaneously a new chemisorbed link is formed. $2NiH + Ni\cdots D_2 \rightleftharpoons Ni\cdots H\text{-}D\text{-}D\cdots Ni + NiH \rightleftharpoons NiH + Ni\cdots HD + NiD$. The mechanism is also applied to the formation of a deutero-olefine. F. J. L.

Catalytic isotopic exchange of gaseous oxygen. **IV.** Exchange between oxygen atoms and water vapour on the surface of oxides of calcium, titanium, vanadium, chromium, manganese, iron, and nickel. N. MORITA, H. TANAKA, and T. TITANI (Bull. Chem. Soc., Japan, 1939, **14**, 9—15).— Exchange reactions have been carried out at various temp. for each oxide and the enrichment of ^{18}O has been determined. W. R. A.

Catalytic hydrogenation by finely divided metals and its mechanism. G. DUPONT and P. PIGANIOL (Bull. Soc. chim., 1939, [v], **6**, 322—331).— Raney Ni is cryst., the crystallite size being 40— 80 A. By reducing $NiCl_2$ with org. Mg compounds, colloidal Ni has been obtained which is initially four times as active as Raney Ni, but this activity is soon lost. An active Co compound has been similarly prepared. Cryst. structure is not essential to activity. The addition of Cu or Hg reduces the activity of Ni. Colloidal Mn and Ag–Au have been similarly prepared. The latter is inactive and the former, although inactive as a hydrogenating agent, is very active in polymerising C_2H_2. Colloidal Cr, Mo, and W have negligible activity. C. R. H.

Corrosion of tin.—See B., 1939, 275.

Amorphous and crystallised oxide-hydrates and oxides. **LI.** Catalysed oxidation of formic acid with nitrite-oxygen at 20° in presence of simple and mixed metal hydroxide catalysts. A. KRAUSE [with J. FULARSKA]. **LII.** Activation of X-radiographically amorphous ferric hydroxide "ferment" by traces of cupric hydroxide. A. KRAUSE [with A. TUROWSKA and L. KWINT-KIEWICZÓWNA] (Ber., 1939, **72**, [B], 634—637, 637—641).—LI. Oxidation of $0.05N\text{-}HCO_2H$ by $NaNO_2$ is promoted by various samples of amorphous $Fe(OH)_3$, and more strongly by a mixed catalyst containing hydroxides of Fe, Cu, and Mg in the proportion $1:0.1:0.1$. The catalytic action is less marked than with H_2O_2 (cf. A., 1939, I, 152) and is probably retarded by reduction products of HNO_2. Oxidation is not effected by $NaNO_3$.

LII. The oxidation of HCO_2H by H_2O_2 has been studied at 20°, 37°, and 50° in presence of $Fe(OH)_3$

containing varying amounts of hydrated CuO. The effectiveness of the catalyst increases with increasing Cu content up to $Cu/Fe = 0.1$, no effect being observable at $Cu/Fe < 10^{-5}$. The mechanism is discussed. F. L. U

Magnetic transformation and catalytic activity. **VI.** Catalytic investigations with magnesium oxide, ferric oxide, and various kinds of iron and steel in the region of loss of ferromagnetic properties. J. A. HEDVALL and A. BERG (Z. physikal. Chem., 1938, **B, 41**, 388— 395; cf. A., 1938, I, 629).—The catalytic activities of synthetic $Mg(FeO_2)_2$ in promoting the reaction $2CO + O_2 = 2CO_2$, and of crude Fe and a Cr–W steel in promoting the reactions $CO + H_2 = C + H_2O$ and $CO + 3H_2 = CH_4 + H_2O$, have been studied near the Curie points. The reaction velocity–temp. curves show abrupt changes in the neighbourhood of the Curie point, in accord with previous observations. J. W. S.

Hydrogenation of ethane on cobalt catalysts. E. H. TAYLOR and H. S. TAYLOR (J. Amer. Chem. Soc., 1939, **61**, 503—509).—Rate measurements, using $Co\text{-}ThO_2\text{-}Cu$-kieselguhr and four Co–MgO catalysts, show that the activity of Co is $<$ that of Ni, but $\gg$ that of Cu. The reaction on Co is inhibited by H_2, but to a smaller extent than the same reaction on Ni. The dependence of the rate on $[H_2]$ varies with the nature of the second component of the catalyst. The activity of the Co–MgO catalysts studied increases with increasing Co content. E. S. H.

Mechanism of catalytic reactions. **I.** Luminescence of phosphorescent substances in acetone decomposition. P. N. KOHANENKO (Acta Physicochim. U.R.S.S., 1938, **9**, 93—102, and J. Phys. Chem. Russ., 1938, **12**, 131—136).—Phosphorescent substances (I) (Cu-activated ZnS, and activated CaS) luminesce during the thermal decomp. of $COMe_2$ in presence of Ni catalyst. This is probaby due to the recombination of free radicals on the surface of (I), suggesting a chain mechanism of decomp. in which the carrier is the free Me radical. This conclusion is supported by the observation that heating the space between the furnace and (I) causes a marked increase in the luminescence of (I), due presumably to preventing recombination on the walls. The luminescence can be observed at distances 15— 20 cm. from the catalyst at temp. as low as 210°, thus proving the formation of chain carriers on the catalyst surface and the consequent development of chains in space. W. R. A.

Catalyst poisoning and the specificity of active centres. **X.** Orientation of molecules on the surface of the catalyst during the dehydrogenation, on copper, of alcohols of the series $C_nH_{2n+2}O$. A BORK (Acta Physicochim. U.R.S.S., 1938, **9**, 697—702).—Since the adsorption coeffs. of EtOH, $Pr^\alpha OH$, and $Pr^\beta OH$ are the same, it is concluded that they are similarly oriented on the Cu surface, viz., $\overset{|}{\underset{H\ \ H}{-C\text{-}O}}$, and that the resulting products, MeCHO, EtCHO, and $COMe_2$, are attached to the surface by $>C:O$. C. R. H.

Promoter effect of platinic chloride on Raney nickel. II. Effect of alkali on various groups. J. R. Reasenberg, E. Lieber, and G. B. L. Smith (J. Amer. Chem. Soc., 1939, **61**, 384—387).—For reduction of various org. substances (mainly NO_2-compounds), Raney Ni prepared from 7 : 3 or 1 : 1 Al–Ni is equally effective. H_2PtCl_6, added just before the reduction, is a powerful catalyst. Alkali is sometimes a poison (for neutral NO_2-compounds), but often a catalyst. $NiCl_2$ hinders reduction of $PhNO_2$. R. S. C.

Activity of different catalysts for vapour-phase esterification. S. K. K. Jatkar and R. K. Valvekar (J. Indian Inst. Sci., 1938, **21**, A, 449—454).—With equal rates of flow of EtOH and AcOH vapours over the catalysts Fe^{III} alum, 10% ZrO_2, $NaHSO_4$, SiO_2 gel, H_3PO_4, activated C, and $KHSO_4$ at 150° esterification corresponded respectively with 5, 38, 40, 70, and 80% conversion. Esterification with the best catalysts, activated C and $KHSO_4$, corresponded with 89% and 94% of the equilibrium conversion, a lower rate of flow of vapour failing to increase the conversion due to temporary poisoning of the catalyst by H_2O vapour liberated. F. H.

Kinetics of reactions taking place in presence of mixed catalysts. V. I. Karshev and P. Z. Sorokin (J. Phys. Chem. Russ., 1938, **12**, 42—49).—At 450—500° in presence of a Cr catalyst n-C_7H_{16} gives chiefly aromatic, and n-$C_{10}H_{22}$ both unsaturated and aromatic, hydrocarbons. The kinetics of the reaction and its temp. coeff. have been measured. J. J. B.

Heterogeneous catalysis. II. Promotion in the hydrogenation of benzene. A. Juliard and C. Herbo (Bull. Soc. chim. Belg., 1938, **47**, 717—769).—The effect of promoters on the catalytic activity of Co and Ni in the hydrogenation of C_6H_6 to C_6H_{12} at 70—300° has been studied. Certain abnormalities in the effects of varying the temp. and the mass of the catalyst are due to inhibition by C_6H_6, which becomes marked at <150°. Above this temp. the % conversion increases with decreasing temp., and the most active catalysts give quant. conversion between certain temp. Ni and Co alone have a slight activity which may be due to promoter action of traces of oxide. Fe, Cu, Cd, and small percentages of $CaCO_3$ and $BaCO_3$ are inhibitors. Oxides of Li, K, and Mg, and more especially of Al, Cr, Ce, Be, and Zn, have marked promoter action. The general behaviour of the catalysts, and its dependence on composition and temp., are analogous to those found in the reverse reaction (A., 1938, I, 205), and the same interpretation holds. F. J. G.

Catalytic hydrogenation of organic compounds with carbon monoxide.—See A., 1939, II, 167.

Effect of activated charcoal on biological inversion of sucrose solutions.—See A., 1939, III, 323.

Deposition of metals on monocrystals. K. M. Gorbunova (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 467—470).—The deposition of metals on Zn monocrystals by electrolysis or displacement has been studied. The orientation of deposited Zn and of Tl (which crystallises in the same system) corresponds exactly with the underlying lattice, but Cd appeared as a layer growing from an edge in two dimensions over the surface of the monocrystal without any relation between the orientation of Cd crystals and the basic Zn face. J. A. K.

Electrodeposition of aluminium from fused salt solutions.—See B., 1939, 277.

Electrolysis of fused aluminium sulphide.—See B., 1939, 277.

Electrolytic formation of azo-dyes.—See B., 1939, 246.

Increase of yield in formation of nitric oxide in the gas phase in the electric arc at high frequencies and under reduced pressure. E. Briner, B. Siegrist, and H. Paillard (Helv. Phys. Acta, 1936, **9**, 555—562; Chem. Zentr., 1937, i, 273—274; cf. A., 1936, 571).—Data are given for the effect on the energy yield of HNO_3 from air or $N_2 + O_2$ of the gas pressure (>1 atm.), frequency ($\ngtr 10^7$ cycles per sec.), and power dissipated in the discharge ($\ngtr 90$ w.). The use of high frequencies is beneficial. A. J. E. W.

Dissociation of nitrogen peroxide in the silent electric discharge. L. Grillet and P. M. Duffieux (J. Phys. Radium, 1939, [vii], **10**, 82—96).—Spectroscopic investigation of a current of NO_2 subjected to a silent electric discharge at low pressure indicates that dissociation of the NO_2 occurs in two stages: (i) $NO_2 \rightarrow NO$ (neutral and ionised) + O, followed by $NO + NO_2 \rightarrow N_2O_3$, and (ii) $N_2O_3 + O \rightarrow N_2 + 2O_2$. A mechanism is proposed for the afterglow of NO_2, which is attributed to the destruction of metastable N_2 mols. W. R. A.

Equilibria in electrodeless discharge. VI. Influence of rate of flow on the formation of ozone in the Siemens ozoniser. R. Krishnan and S. K. K. Jatkar (J. Indian Inst. Sci., 1938, **21**, A, 467—475).—The apparent % conversion of O_2 depends on the simultaneous production of O_3 and at. O, the latter having a reducing action on O_3. Thus for certain rates of passage in the ozoniser the apparent yield of O_3 is zero. At. O is more stable in air than in O_2. L. J. J.

Energy of photochemical chemiluminescent, and electrochemical reactions. P. van Rysselberghe (Bull. Acad. roy. Belg., 1938, [v], **24**, 833—840).—Mathematical. W. R. A.

Secondary reaction in the photolysis of ammonia. W. Mund and A. van Tiggelen (Bull. Soc. chim. Belg., 1938, **47**, 940—943). Polemical (cf. Leighton, Coll. des Actualités scient., 1938, No. 655, 27). E. S. H.

Mass and distribution of photolytically produced silver in silver bromide–gelatin emulsions. IV. Dependence of the mass on temperature. W. Meidinger (Physikal. Z., 1939, **40**, 73—77).—The effect of temp. (−140° to 20°) on the amount of Ag deposited in AgBr photographic films by const. strong illumination, the film being treated with H_2O or NO_2', has been determined. The effect when the

films were given a period in darkness after exposure to light was also investigated. In both cases the effect is complicated and varies from one type of emulsion to another. Films which had been subjected to a dark period showed a considerably greater quantity of photolytic Ag than those which had had continuous illumination, the effect being the greater the greater was the no. of dark periods.   A. J. M.

Optical sensitisation of silver halides. VI. Quantum yield in the photo-decomposition of sensitised silver bromide in connexion with the theory of sensitisation. C. S. BAGDASARJAN (Acta Physicochim. U.R.S.S., 1938, 9, 205—207).—Photo-decomp. of a highly disperse suspension of $AgBr$ in H_2O, containing a slight excess of Br', by blue light (4360 A.) proceeds with a quantum yield γ of 1 in presence of Br–$NaNO_2$ as acceptor. If the $AgBr$ contains adsorbed erythrosin (I), photodecomp. by yellow light (5790 A.) in the absence of $NaNO_2$ is accompanied by decolorisation of (I), and $\gamma = 0.05$—0.07; in presence of $NaNO_2$, $\gamma = 0.1$, and no destruction of (I) occurs. Increase in [(I)] does not affect γ. The destruction of (I) in absence of $NaNO_2$ is due probably to oxidation by liberated Br_2. Pyronine G gives $\gamma \sim 0.06$. Each mol. of (I) liberates an average of 4—5 atoms of Ag in presence of $NaNO_2$. The low val. of γ in the sensitisation of $AgBr$ by (I) indicates the existence of side processes, tending to deactivate the mol. excited by (I). The possible mechanisms of sensitisation are discussed.   W. R. A.

Theoretical considerations on the sign of photodichroism. S. NIKITINE (Compt. rend., 1939, 208, 513—515; cf. A., 1938, I, 528).—The occurrence of positive photodichroism produced by indirect insolation is discussed.   A. J. E. W.

Photo-electrochemical phenomena. K. M. KOSONOGOVA (Mem. Phys. Ukrain., 1937, 6, 59—61). —When a Ag-plated Cu plate carrying a AgI layer is dipped in an electrolytic solution [e.g., of $Pb(NO_3)_2$)] and irradiated, preferably under a cathodic polarisation, a photographic impression becomes visible; the irradiated spots are dark and remain so for a year.   J. J. B.

Photolysis of the aliphatic aldehydes. VII. Crotonaldehyde at elevated temperatures. F. E. BLACET and J. E. L. VALLE (J. Amer. Chem. Soc., 1939, 61, 273—276; cf. A., 1938, I, 366).—Crotonaldehyde (I) undergoes heterogeneous thermal decomp. at 150—400°, yielding CO and unsaturated hydrocarbons. Photo-decomp. occurs at 150° and increases rapidly with rise of temp. At const. temp. the decomp. increases with decrease of λ; the quantum yield is not large except in the second electronic region of absorption. At const. temp. and λ the quantum yield apparently approaches 1 with decrease of (I) concn. The gaseous products of photodecomp. are CO 60, unsaturated hydrocarbons 27, H_2 67, CH_4 7%.   E. S. H.

Photolysis of acetaldehyde in presence of iodine. E. GORIN (Acta Physicochim. U.R.S.S., 1938, 9, 681—696).—The constancy of the quantum yields for the formation of MeI indicates two primary reactions, $MeCHO + h\nu \to Me + HCO$ and $MeCHO$

$+ h\nu \to CH_4 + CO$. The relative probabilities of the first and second of these reactions decrease with λ from 2.6 : 1 at 3130 A. to 1 : 2.9 at 2537 A. The HCO radical is apparently very stable as only above 100° does it react with I. More CO than CH_4 is formed in presence of I, possibly on account of $2HCO \to CH_2O + CO$. Photopolymerisation takes place only in absence of I, and it is thought that it is induced by free radicals. The quantum yield is discussed mathematically.   C. R. H.

Ultra-violet irradiation of *apo*cholic, dihydroxycholenic, and *iso*dihydroxycholenic acid.—See A., 1939, II, 160.

Influence of electromagnetic waves on the course of chemical reactions. A. P. FORJAZ (Congr. int. Quim. pura apl., 1934, 9, II, 518—525; Chem. Zentr., 1937, i, 510; cf. A., 1934, 40).—A periodic variation of n is observed on submitting a mixture of 5 c.c. of EtOH, 5 c.c. of HCO_2H, and 200 c.c. of H_2O to the action of electromagnetic waves. With different conductors the activity decreases in the order Ag, Cu, Al, Ni, Pb; the n variation increases with λ. The effect is influenced by seasonal and geographical factors. The action of electromagnetic waves is compared with that of catalysts.   A. J. E. W.

Dehydration of $Li_2O_2,H_2O_2,3H_2O$. A. AGUZZI (Gazzetta, 1938, 68, 816—819).—When this substance is dehydrated rapidly, H_2O is eliminated more rapidly than H_2O_2. The reaction has also been followed by means of X-ray measurements.   O. J. W.

Corrosion of copper in aqueous ammonium salts. I. Mechanism of corrosion. E. M. ZARETZKI and G. V. AKIMOV (J. Appl. Chem. Russ., 1938, 11, 1161—1172).—Cu is not corroded by aq. NH_3 or NH_4Cl in absence of O_2. In its presence corrosion consists of 3 successive processes : (i) dissolution of Cu, with formation of Cu_2O–NH_3 complexes (corrosion with O_2 depolarisation), (ii) oxidation of Cu^I to Cu^{II}, and (iii) electrochemical reaction of the Cu^{II} complex with Cu, to regenerate the Cu^I complex. Reaction (iii) constitutes a separate cycle, and is chiefly responsible for corrosion; during this part of the process the Cu becomes strongly electronegative. The corrosive action of aq. NH_3 is $>$ of NH_4Cl; the velocity of reaction $\propto [NH_3]$ in the former case, and is max. in N-NH_4Cl, in the latter. The relatively weaker action of NH_4Cl is ascribed to instability of the Cu complexes in its presence.   R. T.

Preparation of pure oxides by ignition of sulphates. A. A. KAZANTZEV (J. Appl. Chem. Russ., 1938, 11, 1108—1111).—$Cu(OH)_2$ is pptd. from aq. $CuSO_4$ by adding the requisite amount of aq. NH_3, the ppt. is collected, without washing or drying, and ignited at 800—900°, to yield CuO containing 0.01—0.14% of SO_4''.   R. T.

Structure of cupriferrocyanides. III. Double exchange reactions between cupriferrocyanides and bivalent cations. R. RIGAMONTI (Gazzetta, 1938, 68, 809—816; cf. A., 1937, I, 350).—X-Ray measurements show that the products obtained by pptn. of $K_2Cu[Fe(CN)_6]$ with solutions of $Zn^{..}$, $Co^{..}$,

and $Ni^{..}$ are probably the compounds $MCu[Fe(CN)_6]$, where $M = Zn$, Co, and Ni. These have the same cubic structure as $Cu_2[Fe(CN)_6]$. The corresponding products obtained with $Cd^{..}$ and $Pb^{..}$ appear to be mixtures of the ferrocyanides of Cu with those of Cd or Pb, whilst the products obtained with $Cu^{..}$, $Sr^{..}$, $Ba^{..}$, and $Mg^{..}$ are compounds of the type $MCu[Fe(CN)_6]$, which have a lower symmetry than cubic. Electron diffraction measurements show that when the bivalent ions react with $K_2Cu[Fe(CN)_6]$ in the form of a thin film, the product has the same structure as the latter, independently of the nature of the substituting metal.   O. J. W.

Preparation of calcium hydrosilicates by hydrothermal synthesis. A. I. KRIAGOVA (J. Appl. Chem. Russ., 1938, **11**, 1103—1107).—SiO_2 gel and $Ca(OH)_2$ are autoclaved (8 hr. at 8 atm.), to give Ca hydrosilicates, in theoretical yield. The rate of rise of temp. when the products are heated is uniform to 370—520°, at which a halt, due to elimination of H_2O from $Ca(OH)_2$, is observed.   R. T.

Chemical softening of water.—See B., 1939, 223.

Formation and dissociation of strontium peroxide. C. HOLTERMANN and P. LAFFITTE (Compt. rend., 1939, **208**, 517—518).—99·2—99·5% SrO_2 is formed reversibly from SrO and O_2 at 350—400° and 200—250 atm. The use of dry O_2 and of SrO free from $Sr(OH)_2$ and $SrCO_3$ is essential. Dissociation pressures (360—673 mm.) at 326—351° are recorded; the calc. mean vals. of Q_0 and Q_{293} are 19,290 and 20,320 g.-cal., respectively. Nernst's formula gives a dissociation temp. of 357° at 760 mm.   A. J. E. W.

Fractionation of radium in the precipitation of barium iodate from various solutions of radium-containing barium salts. B. GOLDSCHMIDT (J. Chim. phys., 1938, **35**, 407—413).—The fractionation of Ra–Ba salts by pptn. of $Ba(IO_3)_2,H_2O$ has been followed using Ac-X instead of its isotope Ra to facilitate determination. The coeff. of fractionation increases with concn. of Ba salt, with the strength of the anion in the order $OAc' < HCO_2' < NO_3' < Br' < Cl'$ for a fixed concn., and with ionic strength of solution in presence of KBr. The results agree qualitatively but not quantitatively with the theory of Ratner but are in disagreement with Polessitski's results (cf. A., 1938, I, 614), which are criticised.   F. H.

Magnesium hydroxyapatite. A. A. SANFOURCHE (Compt. rend., 1939, **208**, 201—203).—$3Mg_3(PO_4)_2,Mg(OH)_2,nH_2O$ is prepared by treating aq. Na_3PO_4 with an excess of $Mg(OH)_2$, dissolved in conc. aq. $MgCl_2$, at room temp. ($n = 23$) or at 80° ($n = 15$), or by boiling $Mg_3(PO_4)_2$ with an excess of $0·01N$-NaOH ($n = 25·4$). $Mg_3(PO_4)_2,16H_2O$ is not hydrolysed by boiling H_2O. The products are decomposed by H_2O; their characteristic dehydration on heating is described.   A. J. E. W.

Zinc corrosion. I. Action of distilled water on zinc. II. Action of distilled water on zinc in presence of air containing various amounts of carbon dioxide. M. F. TABOURY and E. GRAY (Bull. Soc. chim., 1939, [v], **6**, 368—373, 374—382).— I. Thin plates of Zn containing traces of metallic impurities are oxidised by freshly boiled distilled H_2O even in absence of air.

II. In presence of air of low CO_2 content, oxidation is continuous with the formation of $ZnCO_3,2Zn(OH)_2$ (I). As the CO_2 content is increased a protective layer of (I) prevents further oxidation. In contact with air (I) loses CO_2 to form $ZnCO_3,3Zn(OH)_2$.   C. R. H.

Volatile compound of aluminium, boron, and hydrogen. H. I. SCHLESINGER, R. T. SANDERSON, and A. B. BURG (J. Amer. Chem. Soc., 1939, **61**, 536).—AlB_3H_{12}, prepared by treatment of $AlMe_3$ with excess of B_2H_6 at temp. $\not> 80°$, has m.p. $-64·5 \pm 0·5°$, v.p. at 0° 119 mm., b.p. (extrapolated) 44°. The gas is stable, but the liquid undergoes slow polymerisation at room temp. With Me_2O a liquid of low v.p., AlB_3H_{12},Me_2O, is formed. Ammoniates have been obtained, but not isolated. Reaction with NMe_3 yields a mixture of products containing BH_3,NMe_3.   E. S. H.

Preparation of aluminium carbide. R. A. C. GHERZI (Rev. Fac. Cienc. Quím. La Plata, 1937, **12**, 37—41).—For laboratory use the method of Guntz and Masson (A., 1897, ii, 262) is preferred.   F. R. G.

Concentration of ^{13}C by chemical exchange. I. ROBERTS, H. G. THODE, and H. C. UREY (J. Chem. Physics, 1939, **7**, 137—138).—In the exchange between gaseous HCN and aq. NaCN, ^{13}C is conc. in the gas phase and ^{15}N, to a smaller extent, in the liquid phase. The retardation of the autocatalytic polymerisation of HCN in solution by Na_2SO_3 is discussed.   W. R. A.

Preparation of pure titanium iodides. J. D. FAST (Rec. trav. chim., 1939, **58**, 174—180).—The prep. of TiI_4, TiI_3, and TiI_2 by direct action of I on Ti is described. TiI_3 decomposes at 350° in a high vac.; $2TiI_3 \rightleftharpoons TiI_2 + TiI_4$. TiI_2 decomposes in a high vac. at 480° according to $2TiI_2 \rightleftharpoons Ti + TiI_4$; the gaseous phase in equilibrium with solid TiI_2 consists of TiI_4 and volatilised TiI_2.   E. S. H.

Extraction of germanium and gallium from germanite. III. Recovery of germanium from the arsenious sulphide sublimates. L. S. FOSTER and R. Y. TOMPSON (J. Amer. Chem. Soc., 1939, **61**, 236—237; cf. A., 1935, 1470).—The Ge content of the As_2S_3 sublimates is sufficient to warrant recovery. Ge is separated from As in an ammoniacal extract of the sublimates by fractional pptn. of the respective sulphides by controlling the $[H^{.}]$.   E. S. H.

Preparation of acid thorium orthoarsenates. P. CASTEL (Compt. rend., 1939, **208**, 37—38).—By mixing H_3AsO_4 and $Th(NO_3)_4$ at 22° $Th(H_2AsO_4)_4,6H_2O$ is formed when the ratio $ThO_2 : As_2O_5$ is small and $Th(H_2AsO_4)_4,5H_2O$ when the ratio is larger.   W. R. A.

Trithoric orthophosphate. P. CASTEL (Compt. rend., 1939, **208**, 519—520).—A microcryst. ppt. of $Th_3(PO_4)_4,12H_2O$ (I) is obtained on adding aq. H_3PO_4 to a large excess of aq. $Th(NO_3)_4$ or $ThCl_4$ at 18°. (I) is sol. in mineral acids (except HF) and in $Th(NO_3)_4$ and $ThCl_4$ solutions; on heating in a vac. at 850°, anhyd. $Th_3(PO_4)_4$ is formed.   A. J. E. W.

Concentration of ^{15}N. H. G. THODE and H. C. UREY (J. Chem. Physics, 1939, **7**, 34—39).—A three-unit cascade system for ^{15}N enrichment is described. NH_4NO_3 solution is fed into the top of each unit and allowed to drain through the packed sections of the unit and encounter an upward-moving stream of NH_3 generated in reaction vessels, situated at the end of each unit, by the action of NaOH on the NH_4NO_3 solution which has drained from the unit. The reaction $^{15}NH_3 + {}^{14}NH_4^{\cdot} \rightleftharpoons {}^{15}NH_4^{\cdot} + {}^{14}NH_3$ takes place. Material from the first unit (24 m. × 7 cm., in five sections each 4·5 m. long and one 1·5-m. section) is operated on in the second unit (12 m. × 2·2 cm., in two 4·5-m. and one 3-m. sections) and the product obtained passes to the third unit (7·5 m. × 1 cm., in one 4·5-m. and one 3-m. sections) for further treatment. Dimensions of the units, circulating systems for the reactants, the products, and the waste materials, and the packing materials for the various columns are described. The isotopic enrichment was determined by a mass spectrometer (A., 1937, I, 473). Pressures of 5 cm. Hg in the first and of 9 cm. Hg in the second and third units were used. After operating for 40 days 31 g. of material were obtained containing ^{15}N in excess of the normal and varying in concn. from 0·57 to 70·6% ^{15}N. The final concns. of ^{15}N at the lower ends of the three units were (i) 2·61, (ii) 18·9, (iii) 72·8%.   W. R. A.

Formation of sodium metaniobate from niobium tetroxide and oxygenated sodium salts. P. SÜE (Compt. rend., 1939, **208**, 440—442).—Na_2O,Nb_2O_5 (with Nb_2O_5 in some cases) is formed on heating Nb_2O_4 with Na_2CO_3, NaOH, Na_2SO_4, Na_2SO_3, $NaNO_3$, or $NaNO_2$; this illustrates the strong reducing action of Nb_2O_4. The reactions are described in detail.   A. J. E. W.

Rôle of sulphuric acid in reactions brought about in its presence. R. LANTZ (Bull. Soc. chim., 1939, [v], **6**, 302—316).—Literature on sulphonation, nitration, etc. and on the physical properties of H_2SO_4 solutions is reviewed and discussed with reference to suggested mechanisms for the rôle of H_2SO_4 in such reactions.   C. R. H.

Interaction of sulphur trioxide with salts of mineral oxyacids. P. BAUMGARTEN and C. BRANDENBURG (Ber., 1939, **72**, [*B*], 555—563; cf. A., 1939, I, 90).—SO_3 reacts at ≯40° with $K_4P_2O_7$, KPO_3, and K_3PO_4 to give $K_2S_3O_{10}$ and P_2O_5. Na_2CO_3 at 40° gives $Na_2S_2O_7$ and CO_2. $K_2S_2O_6$ at 35° and $K_2S_2O_3$ at 40° give $K_2S_3O_{10}$ and SO_2. $K_2S_2O_8$ at 40° gives $K_2S_3O_{10}$ and gaseous products.   F. L. U.

Polythionates. V. Action of arsenic and antimony compounds in formation of polythionates from thiosulphate. C. J. HANSEN (Ber., 1939, **72**, [*B*], 535—554; cf. A., 1934, 1082).—Experimental study of the decomp. of $H_2S_2O_3$ in presence of $AsCl_3$ or $SbCl_3$ shows that two different types of reaction occur. In a strongly acid medium the As or Sb compound catalyses the formation of polythionate, as represented by : $5S_2O_3'' + 6H^{\cdot} = 2S_xO_6'' + 2(5 - x)S + 3H_2O$. The other type is non-catalytic and depends on the formation of a complex ion, e.g., $As(S_2O_3)_3'''$, which can decompose

to give either As_2S_3 and S_3O_6'', or the free ion-radical $S \cdot SO_2 \cdot O'$. The latter then dimerises, with or without previously taking up additional S, to S_4O_6'' or a higher polythionate ion respectively. In practice no one of these reactions, of which the final products are the resultant, occurs exclusively. In no case is S_5O_6'' the initially formed polythionate.   F. L. U.

Evidence favouring the existence of the compound hydrogen perselenide. J. P. NIELSEN, S. MAESER, and D. S. JENNINGS (J. Amer. Chem. Soc., 1939, **61**, 440—441).—A gas which has the empirical formula *HSe* is obtained by reduction of H_2SeO_3 by Al and HCl.   E. S. H.

Ferromagnetic compounds of chromium. L. F. BATES and G. G. TAYLOR (Proc. Physical Soc., 1939, **51**, 33—36; cf. A., 1936, 1329).—When powdered Cr prepared from Cr amalgam is heated with S in vac. a series of ferromagnetic compounds is formed. Curie points and sp. magnetisations of the specimens are reported.   N. M. B.

Reduction and decomposition of chromic anhydride. J. M. DUNOYER (Compt. rend., 1939, **208**, 520—521).—Decomp. of CrO_3 to Cr_2O_3 and O_2 commences at ∼100° and is appreciable at the m.p. (170°); the decomp. is independent of the O_2 pressure. Reduction by H_2 is a slow reaction which is detectable above ∼25°; at >130° the rate of decomp. exceeds that of reduction. The reactions were studied by observing the pressure change with steadily increasing temp.   A. J. E. W.

Separation of the chlorine isotopes. K. CLUSIUS and G. DICKEL (Naturwiss., 1939, **27**, 148).—The separation of the Cl isotopes has been effected by a method combining thermo-diffusion and thermo-siphon action (A., 1938, I, 539). On the " heavy " side, 8 c.c. of HCl containing 99% ^{37}Cl were obtained per day. On the " light " side, 2 l. of HCl containing Cl of at. wt. 35·147 were obtained. It was also possible to obtain 25 c.c. per day of HCl with Cl of at. wt. 35·06.   A. J. M.

Formation of bromous acid in the action of bromine on silver nitrate. (MLLE.) M. L. JOSIEN (Compt. rend., 1939, **208**, 348—350).—HOBr, $HBrO_2$, and $HBrO_3$ are determined in presence of one another by titrating the oxidising power for As_2O_3 and KI, and the [Br′] after reduction (Mohr's method). $HBrO_2$ is formed by the action of Br on N-$AgNO_3$, probably by oxidation of HOBr by the Br.   A. J. E. W.

Stability of manganic sulphate in aqueous sulphuric acid solutions. L. DOMANGE (Compt. rend., 1939, **208**, 284—285).—$Mn_2(SO_4)_3$ is stable in solutions containing >75·25% of H_2SO_4 (16°). Treatment with 70% H_2SO_4 gives $Mn_2(SO_4)_3, H_2SO_4, 6H_2O$ as a brown cryst. powder.   A. J. E. W.

Affinity. LXXXVI. Affinity of rhenium for arsenic. F. WIECHMANN and M. HEIMBURG [with K. MEISEL] (Z. anorg. Chem., 1939, **240**, 368).—A correction (cf. A., 1939, I, 155).

Topochemically-prepared ferric hydroxide. H. W. KOHLSCHÜTTER and H. SIECKE (Z. anorg. Chem., 1939, **240**, 232—240).—$Fe(OH)_3$ obtained as

a pseudomorph by the action of $2N$-NH_3 on a solid Fe^{III} salt differs from the ordinary ppts. in its behaviour towards H_2O vapour and in its degree of porosity as indicated by the increase of catalytic efficiency on drying. The most characteristic product is obtained from $Fe_2(SO_4)_3$. Its properties are compared with those of products obtained from other solid Fe^{III} salts and from solution. F. J. G.

Preparation of ferric oxide by various methods of oxidation. III. Oxidation of metallic iron by air in presence of ferrous salts and accelerators. I. RISKIN (J. Appl. Chem. Russ., 1938, **11**, 1085—1090).—Fe turnings are placed in aq. $FeSO_4$-$NaOAc$, at 70°, and air is passed for 4—8 hr.; Fe_2O_3, suitable for prep. of paints, is obtained in good yield. R. T.

Dissymmetrical synthesis in the case of complex metallic salts. III. I. LIFSCHITZ (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 173—180; cf. A., 1937, II, 91).—Previous work on cases of apparent asymmetric synthesis in metallic complexes is discussed in relation to the Cotton effect. Co complexes of the type $[Co\ en_2A]X_2$ ($A = l$-leucine, d-alanine, or glycine) have been prepared and resolved by means of their d-α-bromocamphor-π-sulphonates or d-tartrates. $[\alpha]$ and rotatory dispersion of these salts and of certain derived halides are recorded. J. A. K.

Constitution of heteropoly-acids. I. Complex phosphododecamolybdates. G. SPACU and V. NICOLAESCU (Bul. Soc. Ştiinţe Cluj, 1938, **8**, 45—59).—Using phosphododecamolybdic acid, $[P(Mo_2O_7)_6]H_7,26H_2O$, 8 new *complexes* have been obtained :—
cis-$[P(Mo_2O_7)_6]H[Co\ en_2Cl_2]_6,13H_2O$;
$[P(Mo_2O_7)_6]H[Co\ en_2(SCN)_2]_6,17H_2O$;
$[P(Mo_2O_7)_6][Co\ en_2(NO_2)_2]_7,16H_2O$;
$[P(Mo_2O_7)_6][Co(NH_3)_4(NO_2)_2]_7,14H_2O$;
$[P(Mo_2O_7)_6][Co(NH_3)_5Cl]_3[Co(NH_3)_5Cl]OAc,14H_2O$;
$[P(Mo_2O_7)_6](Cr(NH_3)_5Cl]_3[Cr(NH_3)_5Cl]NO_3,13H_2O$;
$[P(Mo_2O_7)_6][Cr(NH_3)_5Cl]_3[Cr(NH_3)_5Cl]Cl,13H_2O$; and
$[P(Mo_2O_7)_6][Co\ en_3]_2[Co\ en]Cl_2,17H_2O$. W. R. A.

Metallic carbonyls. XXVIII. High-pressure synthesis of cobalt carbonyl and cobalt carbonyl hydride from cobalt compounds. W. HIEBER, H. SCHULTEN, and R. MARIN (Z. anorg. Chem., 1939, **240**, 261—272).—In presence of Cu, CoS reacts quantitatively with CO at 200 atm. and 200° to form $[Co(CO)_4]_2$. CoI_2 in presence of Cu or Ag reacts similarly at 145 atm. and 160°. The use of an autoclave lined with Cu renders the addition of metal unnecessary. In presence of H_2O or other H compounds, or of H_2, or by the use of CoH_2, a good yield of $HCo(CO)_4$ can be obtained at >200 atm. and 180°. $HCo(CO)_4$ can also be obtained by direct union of $[Co(CO)_4]_2$ and H_2 at 250 atm. and 200°, so that its dissociation is reversible. $HCo(CO)_4$ can be synthesised from Co, CO, and H_2. F. J. G.

Nitric oxide compounds of cobalt (I) halides. W. HIEBER and R. MARIN (Z. anorg. Chem., 1939, **240**, 241—260).—NO reacts at >60°, and rapidly and quantitatively at 110°, with anhyd. CoI_2, liberating I and forming *dinitroso-Co^I iodide*, $Co(NO)_2I$ (I),

which sublimes as brownish-black crystals, m.p. 131°, decomp. 210°. It is sparingly sol. in most org. solvents and (with partial decomp.) in H_2O, but is readily sol. in EtOH. Dil. acids liberate NO, N_2O, and N_2, and the solution then contains Co^{II} and I'. It dissolves in conc. $Na_2S_2O_3$ with an intense dark green colour forming $[Co(NO)_2(S_2O_3)_2]'''$. It is very resistant to the continued action of NO, even at 150 atm., and is not affected by CO at 250 atm. and room temp., but at 320 atm. and 160° $Co(NO)(CO)_3$ and $[Co(CO)_4]_2$ are formed. C_5H_5N and $(CH_2\cdot NH_2)_2$, by direct action on (I) or its EtOH solution, displace part of the NO, affording the *compounds* $Co(NO)I,6C_5H_5N$ and $Co_2(NO)_3I_2,5(CH_2\cdot NH_2)_2$, whilst with o-phenanthroline the *additive compound* $Co(NO)_2I,C_{12}H_8N_2,EtOH$ is formed. The *dinitroso-bromide*, $Co(NO)_2Br$, m.p. 116°, and -*chloride* $Co(NO)_2Cl$, m.p. 101°, are obtained by analogous reactions with the addition of Zn or Co to take up the liberated halogen. They resemble (I) but are rather more sol. in H_2O. The brown solution reduces $AgNO_3$ to Ag, and is decolorised by $KMnO_4$ and by H_2O_2. An EtOH solution of anhyd. CoI_2 absorbs NO at room temp. with liberation of I and formation of (I) in solution. F. J. G.

Sensitivity of chemical reactions. II. Reactions of anions. Z. KARAOGLANOV (Z. anal. Chem., 1939, **115**, 305—331; cf. A., 1938, I, 637).—Sensitivities determined by standardised procedures and expressed in μg. per 10 c.c. are recorded for many methods used in determining inorg. anions. Only relatively few reactions are equally sensitive for the detection of both the cation and the anion, this being attributed to differences in the effect of the concn. of the reagent solution and its action on the colloidal state of the ppt. produced. J. W. S.

Accuracy of colorimetric methods of analysis. I. A. RINGBOM. **II.** A. RINGBOM and F. SUNDMAN (Z. anal. Chem., 1939, **115**, 332—343, 402—412).—I. The fundamental differences between the subjective (visual) and objective (photo-electric) methods of colorimetric analysis, and their relative merits, are discussed. When the Lambert–Beer law holds, the concn. of absorbent can be determined most accurately by the photo-electric method when the extinction is 0·434 (light absorption 63·2%), under which conditions an error of 1% in measurement of the light absorption leads to an analysis error of 2·72%. A method is described for determining the optimum conditions when the Lambert–Beer law does not hold. The various methods of operation with the Lange colorimeter are compared and discussed.

II. The validity of the Lambert–Beer law in the blue colour produced with Cu^{II} salts and NH_3, the green colour of Ni salts, the red colour of Co salts, and the blue colour produced with Co salts and CNS' has been tested, and the absorption of these solutions applied to the determination of Cu, Ni, and Co by means of the Lange colorimeter in conjunction with suitable glass filters. The limits of error are in accord with theory. Ni and Co can be determined in the same solution if conc. Ni^{II} solutions are used as filter for the $Co^{\cdot\cdot}$ determination, and vice versa. J. W. S.

Spectrographic analysis.—See B., 1939, 278.

Fluorescence analysis of inorganic materials.
C. E. WHITE (Ind. Eng. Chem. [Anal.], 1939, **11**, 63—
66).—A review of technique and applications.

L. S. T.

Isolation and determination of traces of metals. The dithizone system. H. J. WICH-MANN (Ind. Eng. Chem. [Anal.], 1939, **11**, 66—72).—
The isolation of the dithizone group of metals by extraction from aq. solution, and their separation from each other under controlled p_H or by competitive complex formation, are discussed. The need for physico-chemical investigation of the various equilibria involved, which would greatly facilitate these separations, is emphasised. Methods used for the determinations of the metals after their extraction are outlined, and future developments discussed. L. S. T.

Experiments with a new combination of indicators (universal indicator). J. H. N. VAN DER BURG (Chem. Weekblad, 1939, **36**, 101—102).—
An indicator comprising thymol-blue (5 mg.), Me-red (25 mg.), bromothymol-blue (60 mg.) and phenolphthalein (60 mg.) in 100 c.c. of 75% EtOH gives clearly seen colours from red, through orange, yellow-green, blue, and indigo to violet as p_H changes by 1 from 4 to 10. S. C.

Experimental basis of the determination of hydrogen ions by colour analysis. A. G. DE ALMEIDA (Mikrochem., 1939, **26**, 9—21).—The colours produced by bromophenol-blue, bromocresol-purple, bromothymol-blue, phenol-red, cresol-red, and thymol-blue in buffer solutions of various p_H have been examined through red, green, and blue filters with the Pulfrich photometer, and the saturation, tint, and brightness for each solution are deduced. Curves of p_H against tone vals. are of an S-shape, and their equations are deduced. Colour measurements in presence of a suitable indicator permit the determination of p_H with an error of 0·002—0·004, an accuracy unattainable by electrometric methods.

J. W. S.

Measurement of the deuterium content in mixtures of water and deuterium oxide. K. LINDERSTRØM-LANG, O. JACOBSEN, and G. JOHANSEN (Compt. rend. Lab. Carlsberg, Sér. chim., 1938, **23**, 17—24).—A drop of the mixture is added to a vertical tube containing a mixture of kerosene and PhBr, the d of which varies linearly with height. The position taken up by the drop is compared with the positions of standard drops of known d. E. S. H.

Toluene-distillation method for determination of moisture in foodstuffs.—See B., 1939, 321.

Micro-analytical determination of halogens.
C. WEYGAND and A. WERNER (Mikrochem., 1939, **26**, 177—181).—In the micro-determination of halogens by Busch's method (A., 1934, 1016) the sample (3—4 mg.) is treated with EtOH (3 c.c.), Pd-CaCO₃ catalyst (0·3 g.), KOH in EtOH (1 c.c.), and N_2H_4,H_2O (2 drops), and is heated under reflux (water-bath). Most of the EtOH is then evaporated, and the solution is diluted with H_2O to 20 c.c. and filtered. The filtrate is made strongly acid with HNO_3, treated with $AgNO_3$, and the ppt. collected, washed, and weighed. If a ppt. is formed on acidification the

procedure is repeated using Pd–BaSO₄ catalyst, filtration being carried out only after acidification. In determination of I by Carius' method the substance (3—5 mg.) is introduced into the tube with a pea-size crystal of $HgCl_2$ and HNO_3 (0·3—0·5 c.c.). After heating to convert the I into HgI_2 the tube is washed with H_2O (1 c.c.) and then with N-bleaching powder solution (2 c.c.) to convert the I into IO_3'. After dilution to 50 c.c. 10% HCO_2Na (0·5 c.c.) is added, and the solution boiled for 2 min. to remove Cl_2. After cooling in ice solid KI is added and the solution titrated with 0·01N-$Na_2S_2O_3$. J. W. S.

Application of drop analysis to investigation of medicinal materials. IX. Detection of free chlorine and substances containing chlorine.
O. FREHDEN and C. H. HUANG (Mikrochem., 1939, **26**, 41—43).—Test paper is prepared by impregnation with a solution of fluorescein (0·1 g.) and KBr (0·5—0·8 g.) in dil. NaOH (100 c.c.). In presence of Cl_2 the bright yellow paper turns red owing to interaction of Br, liberated by the Cl_2, with fluorescein to form eosin. The test is invalid in presence of other halogens but other oxidising agents generally give no results, thereby rendering the test preferable to that with starch–KI paper. Cl' is detected after liberation of Cl with H_2SO_4 and MnO_2. J. W. S.

Thiosulphate titration of chlorine. F. J. HALLINAN and W. R. THOMPSON (J. Amer. Chem. Soc., 1939, **61**, 265—270).—The influence of [H˙] and [I'] on oxidation of $Na_2S_2O_3$ induced by Cl_2, and the oxidation of I' by MnO_2, have been studied. With p_H 4·6—7·7 and [KI] 0·05—100 g. per l., $\log (1 - R)/(R - 0·125) = 0·02806(20p_H - 14 \log [KI]) - 4·260$ and $\log t = 0·6p_H - \log [KI] - 2·383$, where R is the ratio of observed to max. titre, [KI] the wt. of KI in g. per l., and t the time required to produce sufficient I by introduction of 0·5 p.p.m. of Mn in a prepared sol to colour an α-naphthoflavone indicator as much as would 0·05 p.p.m. of Cl_2 under the standard conditions of p_H and [KI]. A nomogram for titration of Cl_2 with $Na_2S_2O_3$ in presence of MnO_2 has been devised so as to permit choice of conditions for negligible formation of SO_4'' and interference of Mn.

E. S. H.

Tests for purity of silver iodate prepared for chloride determination. J. SENDROY, jun. (J. Biol. Chem., 1939, **127**, 483—485).—Too high results may be obtained by the author's original method (cf. A., 1937, III, 448) unless all traces of KIO_3 are removed. All samples of $AgIO_3$ should be tested for solubility and used in analyses of standard chloride solutions before the method is adopted. P. G. M.

Use of ammoniacal silver solutions in micro-crystalline qualitative analysis. G. DENIGÈS (Mikrochem., 1938, **25**, 1—4).—Tests for many anions are based on the fact that ammoniacal solutions of many Ag salts are sufficiently unstable to be decomposed by mechanical vibration, the Ag salts being deposited in a cryst. condition suitable for identification by microscopical examination. Procedures for the detection of Cl', Br', CrO_4'', PO_4''', AsO_4''', MoO_4'', $Fe(CN)_6''''$, OAc', HCO_2', $EtCO_2'$, etc. are

given. The method is particularly useful for the detection of certain ions in biological sections.

<div style="text-align: right">L. S. T.</div>

Micro-halogen determination. Fluorine and chlorine. F. HERNLER and R. PFENINGBERGER (Mikrochem., 1938, **25**, 267—348).—A review of the literature.

<div style="text-align: right">L. S. T.</div>

Titration of iodide in presence of chloride with silver nitrate, using Rose-Bengal as adsorption indicator. A. J. BERRY (Analyst, 1939, **64**, 112—113).—In contradiction of previous results (cf. A., 1936, 811) it is shown that when KCl is present the consumption of $AgNO_3$ is 0·3—0·4% > when pure KI is titrated. The error is, however, < that observed by Fajans and Wolff (A., 1924, ii, 776).

<div style="text-align: right">E. C. S.</div>

Application of salts of complex ions to the microscopical detection of anions. V. Nitropentamminocobaltic chloride (xanthocobaltic chloride). VI. Nitritopentamminocobaltic chloride (iso-xanthocobaltic chloride). L. K. YANOWSKI and W. A. HYNES (Mikrochem., 1938, **25**, 57—60, 61—64; cf. A., 1938, I, 267).—V. Characteristic cryst. ppts. are given by aq. $[Co(NH_3)_5NO_2]Cl_2$ and HF_2' (20 μg.), CrO_4'' (2 μg.), S_2O_6'' (0·2 mg.), C_2O_4'' (40 μg.), phosphomolybdate (20 μg.), tartrate (20 μg.), and S_2O_3'' (0·2 mg.). Limits of identification are given in parentheses. The crystals obtained with the first four ions are sufficiently characteristic to serve for detection and identification. Ppts. with phosphomolybdic acid remain non-cryst. Acids and ions which give non-cryst. ppts. or no reaction are enumerated. Photomicrographs are reproduced. VI. Characteristic cryst. ppts. are obtained with aq. $[Co(NH_3)_5(ONO)]Cl_2$ (I) and CrO_4'' (2 μg.), S_2O_6'' (0·2 mg.), C_2O_4'' (20 μg.), ClO_4' (0·2 mg.), Sb_2O_7'' (20 μg.), and S_2O_3'' (0·2 mg.). Limits of identification are given in parentheses. Photomicrographs are reproduced. The crystals obtained with ClO_4' and Sb_2O_7'' are suitable for detection and identification, and owing to its instability, (I) is recommended only for these ions. Ions which do not react or give non-cryst. ppts. are enumerated.

<div style="text-align: right">L. S. T.</div>

Determination of small amounts of oxygen in argon up to 0·002 vol.-%. E. HOFFMANN (Mikrochem., 1938, **25**, 82—84).—A modification of the method of Mugdan and Sixt (A., 1933, 243) by which 0·01 c.c. of O_2 can be detected is described. The gas (500 c.c.) under investigation is brought into contact with a NH_3–$Cu^.$ solution, decolorised by heating in presence of Cu, and the $[O_2]$ determined by means of the colour formed. The time required for a determination is 15—20 min.

<div style="text-align: right">L. S. T.</div>

Determination of dissolved oxygen in water.—See B., 1939, 333.

Direct titration of sulphate. Erythrosin as internal indicator. W. V. BURG (Ind. Eng. Chem. [Anal.], 1939, **11**, 28—30).—50 ml. of the solution containing 0·05—0·19 g. of SO_4'' are acidified (phenolphthalein) with 0·02N-HNO_3, 16 ml. of EtOH and 14 drops of 1% aq. erythrosin B are added, and the mixture is titrated with 0·1M-$Pb(NO_3)_2$ until it is

violet in colour. The temp. should be <30°. Test data for Na_2SO_4 and K_2SO_4 show an average relative error of <0·3%. Cl' but not NO_3' interferes and must be removed by means of $AgNO_3$. Mixtures of Cl' and SO_4'' can be analysed by titrating the Cl' with $AgNO_3$ using fluorescein or dichlorofluorescein as adsorption indicators, and then determining the SO_4'' as above.

<div style="text-align: right">L. S. T.</div>

Determination of sulphur in surface-active agents.—See B., 1939, 239.

Separation of selenium and its determination in lead alloys. B. S. EVANS (Analyst, 1939, **64**, 87—91).—The Reinsch method for the deposition of Sb is applied to the separation of Se from Pb in HNO_3, $CO(NH_2)_2$ being added to prevent redissolution of the film. The film, which consists of Cu_2Se, dissolves instantly in aq. KCN, and the resulting solution is titrated directly by Coleman and McCrosky's method (cf. A., 1937, I, 530). Since Sb is not deposited from solution in HNO_3, Se may be determined in its presence by this method.

<div style="text-align: right">E. C. S.</div>

Photometric determination of selenium in sulphur and crude sulphuric acid.—See B., 1939, 261.

Micro-determination of tellurium. Toxicological applications. L. VIGNOLI and A. BEN KHALED (J. Pharm. Chim., 1939, [viii], **29**, 148—158). —Traces of Te may be detected as follows. The aq. solution (1 c.c.) of tellurate is treated with 2 c.c. of a reagent containing H_2SO_4 (150 c.c.), distilled H_2O (200 c.c.), and NaH_2PO_2 (100 g.). After heating to boiling, HCl (20 drops) is added down the side of the tube so as to form an upper layer. The presence of Te is indicated by the formation of a slaty-grey ppt. at the junction of the two layers, the amount of ppt. being $\propto$ the amount of Te present. A quant. modification of the test also described is applicable to solutions containing 0·5—0·001 mg. The effect of the presence of various elements and ions is discussed.

<div style="text-align: right">W. O. K.</div>

Ultra-micro-Kjeldahl technique. J. NEEDHAM and E. J. BOELL (Biochem. J., 1939, **33**, 149—152). —The technique, allowing the determination of 1—20 μg. of N, is described. The Kjeldahl vessel acts as a Conway dish (A., 1933, 654) and the NH_3 diffuses into an acid film hanging in a hollow wax-coated stopper.

<div style="text-align: right">A. L.</div>

Colorimetric method for the detection of small quantities of nitric acid. R. LANTZ (Bull. Soc. chim., 1939, [v], **6**, 279—280).—0·2 g. of 5-anilo- or 5-β-naphthylimino-as-di-as-naphthoxazine (cf. A., 1934, 1234) is dissolved in 1000 g. of H_2SO_4 (93%). One drop of this reagent mixed with one drop of H_2SO_4 containing HNO_3 gives a violet colour. 0·05 g. of HNO_3 in 1000 g. of H_2SO_4 can be detected. With the reagent one tenth of the above concn., 5 parts of HNO_3 in 10^6 can be detected.

<div style="text-align: right">C. R. H.</div>

Semi-micro-determination of free and saline ammonia in water.—See B., 1939, 333.

Determination of total nitrogen and phosphorus in water.—See B., 1939, 334.

Chemical and physico-chemical basis of the colorimetric micro-determination of phosphoric acid by means of molybdenum-blue. I. Determination of the phosphoric ion. V. ZAMBOTTI (Mikrochem., 1939, **26**, 113—131).—From a review of methods used for determination of H_3PO_4 in biological material it is concluded that the most trustworthy is colorimetric determination as Mo-blue. The theory of the method is discussed, and the conditions necessary for attainment of accurate results are enumerated. Under optimum conditions it is possible to determine 4—5 μg. P in 10 c.c. of solution. It is possible to extend the method to the determination of Mg, but not to that of Zn. A routine method for determination of P and Mg in biological materials is given. J. W. S.

Determination of arsenic in organic and inorganic compounds. D. T. LEWIS and V. E. DAVIS (J.C.S., 1939, 284—286).—As is quantitatively pptd. from solutions of AsO_4''' containing NH_4OAc and slight excess of $AcOH$ by $UO_2(OAc)_2$. After several hr. the ppt. of $NH_4UO_2AsO_4$ becomes coarser and is filtered, excess of $UO_2(OAc)_2$ in the filtrate being titrated in diluted solution with $KMnO_4$. Alternatively $NH_4UO_2AsO_4$ is ignited to a moss-green residue which is dissolved in HNO_3, the solution being evaporated and ignited to give black U_3O_8 which is weighed. AsO_3''' is first oxidised in acid solution by $KBrO_3$. $UO_2(OAc)_2$ gives no ppt. with AsO_3''' in presence of excess of $NH_4{}^{\cdot}$. Org. As compounds are decomposed by heating with H_2SO_4, KNO_3, and starch in a Kjeldahl flask until org. matter is destroyed, As being determined in the diluted solution after oxidation with $KBrO_3$, neutralisation with aq. NH_3, and acidification with $AcOH$. F. H.

Volumetric determination of very small amounts of arsenic even in the presence of antimony. J. BODNÁR, E. SZÉP, and W. CIELESZKY (Z. anal. Chem., 1939, **115**, 412—420).—The method of Gangl and Sánchez (A., 1934, 1084) is capable of determining 5—100 μg. of As with an error of <5% if granulated Zn and H_2SO_4 are used for reduction. Sb, however, is simultaneously reduced and determined with the As. If Sn and HCl are used for reduction, however, As can be determined free from Sb and the time required for the reduction is only 30 min. instead of 2 hr., the error being <5%. The latter arises from incomplete reduction of As and incomplete decomp. of AsH_3. J. W. S.

[Spectral] determination of arsenic, antimony, bismuth, and tellurium in lead.—See B., 1939, 274.

Determination of silica by means of hydroxyquinoline in lead and copper smelting slags.—See B., 1939, 274.

Colorimetric determination of carbon monoxide. S. M. TSCHUMANOV and M. B. AXELROD (J. Appl. Chem. Russ., 1938, **11**, 1236—1237).—The gas is passed through a suspension of Pt or SiO_2 gel in 0·15—3% $Fe_2(SO_4)_3$ containing $K_3Fe(CN)_6$; the blue coloration obtained approx. $\propto$ [CO] of the gas. R. T.

Titration of carbonates by Warder's method, with a protective layer of liquid. F. ČUTA and K. KÁMEN (Chem. Listy, 1939, **33**, 28—31, and Coll. Czech. Chem. Comm., 1939, **11**, 77—84).—Titration of normal to H carbonates is effected under a layer of liquid paraffin, petrol, or C_6H_6, with phenol-, o-cresol-, or α-naphthol-phthalein, or cresol-red. The error is $\not> \pm 0\cdot1\%$. R. T.

Graphic determination [in water] of carbon dioxide and the three forms of alkalinity.—See B., 1939, 334.

Determination of free sodium cyanide and ammonia in brass-plating solutions.—See B., 1939, 274.

Determination of small amounts of emanation in water. J. CLAY and F. WESTERHOF (Physica, 1939, **6**, 177—183).—The H_2O is introduced directly into the ionisation chamber described. L. J. J.

Quantitative analysis of the alkali metals by the spectrographic method. I. Reciprocal effect of the alkali metals on the sensitiveness of the arc spectra to them. M. WADA (J. Soc. Chem. Ind. Japan, 1938, **41**, 377—380B).—The substance is diluted with a refractory excipient, e.g., calcined ZnO, which can be obtained pure and gives only a few lines in the visible portion of the spectrum. Cu electrodes (surface 10 × 2—3 mm.) in the form of plates are coated with the powder. Addition of K to Li, Na, Rb, and Cs increases the intensity of their spectra, the increase being $\propto$ [K]. Na has a similar effect with Li, a slight effect with Rb and Cs, and no effect with K. Li has a slight effect with Cs only. I. C. R.

Sensitivity of de Koninck's potassium reaction and the magnitude of the K_2O factor in Kramer and Tisdall's micro-method for determination of potassium. A. KAWE (Z. anal. Chem., 1939, **115**, 385—399).—By pptn. with $Na_3Co(NO_2)_6$ as $K_2NaCo(NO_2)_6$, 40 μg. of K can be detected in 4 c.c. of solution if the solutions are kept for 5 min. after addition of the reagent. The method is suitable for the determination of K in soil extracts if these are evaporated to 0·1 of their original vol. When the amount of $K_2NaCo(NO_2)_6$ is determined by titration with $KMnO_4$, 1 c.c. of 0·02N-$KMnO_4$ is equiv. to 0·158 mg. of K_2O, not 0·171 mg. as assumed by Kramer and Tisdall (A., 1921, ii, 412). Addition of $Na^{\cdot}$, $NH_4{}^{\cdot}$, $Ca^{\cdot\cdot}$, $Mg^{\cdot\cdot}$, $Fe^{\cdot\cdot}$, SO_4'', Cl', and NO_3' has no effect on the determination. J. W. S.

Determination of potassium with hexanitrodiphenylamine (dipicrylamine). I. M. KOLTHOFF and G. H. BENDIX (Ind. Eng. Chem. [Anal.], 1939, **11**, 94—98).—Gravimetric and volumetric procedures for the determination of macro- and micro-quantities of K as the salt of $NH[C_6H_2(NO_2)_3]_2$ (I), and a colorimetric method for 10—100 μg. of K, are described. The method of Winkel and Maas (A., 1937, I, 45) gives low (3%) results, and the chief source of error lies in the comparatively large solubility of the K salt of (I) in H_2O and in excess of reagent. The solubility of the salt increases markedly with a rise in temp. from 0° to 25°, and washing, and filtration must be effected at 0°. The $K^{\cdot}$ ions are pptd. from

neutral or slightly alkaline solutions with the Mg salt of (I) or with the Na salt when anions that form a ppt. with $Mg^{..}$ are present, and the ppt. is weighed after drying at 110°. NH_4 salts must be absent, and their removal is best effected by boiling with MgO. Co-pptn. of $Na^{.}$ is negligibly small with 10 mg. of K in presence of 100 mg. of Na, but when the ratio Na : K is > 80 : 1, a preliminary separation of the K as cobaltinitrite is advisable. Good results can be obtained in presence of relatively large amounts of Mg, Li, and Ca. $Ba^{..}$ must be removed. Metals which form a ppt. in alkaline solution are best eliminated by boiling with MgO. In the volumetric method, the pptd. K salt is decomposed by means of standard acid, the (I) removed by filtration, and the residual acid titrated with NaOH (bromothymol-blue). In the colorimetric method, the pptd. K salt is filtered by means of a piece of glass tubing carrying asbestos fibres in the lower end, dissolved in $COMe_2$, diluted with H_2O containing 1 ml. of $0.1N$-NaOH per 100 ml., and the yellow to orange-red colour determined by means of a photo-electric colorimeter or Nessler tubes, since Beer's law does not hold. Aq. solutions of the K salt are stable, and the light absorption is unchanged on keeping, or by a rise in temp. from 25° to 40°. Test data are recorded.
L. S. T.

Determination of sodium. N. SCHOORL (Chem. Weekblad, 1939, **36**, 122—123).—The ppt. of $NaMg(or Zn)(UO_2)_3(OAc)_9$ contains 6—6·8 H_2O according to the humidity of the air. The errors are always negative but the method gives excellent results with ≮10 mg. NaCl per c.c. S. C.

Confirmatory tests for lithium, sodium, potassium, cæsium, strontium, and lead. J. I. ADAMS, A. A. BENEDETTI-PICHLER, and J. T. BRYANT (Mikrochem., 1939, **26**, 29—35).—Like Na, Li forms sparingly sol. triple acetates when treated with Mg uranyl acetate (I) or with Zn uranyl acetate (II). In appearance the ppt. given by Li with (I) resembles that from Na with (II), and vice versa. As a drop test these reactions can be utilised to detect ≮0·4 g. of Na or Li. The formation of Na uranyl acetate is a more sp. test for detection of Na. K is best detected by comparing the appearance of droplets of the test solution when treated with H_2PtCl_6 and H_2SnCl_6, respectively, with that of aq. KCl and RbCl when treated with the same reagents. Cs can be detected by the formation of hexagonal plates when treated with $HBiI_4$ in a drop test. In detection of Sr, a small drop of test solution is evaporated on a slide, treated with aq. $Cu(NO_3)_2$ or $Cu(OAc)_2$, and the drop again evaporated. On treatment with nitrite reagent the residue yields a ppt. of small green squares, probably of a K Sr Cu nitrite. The reagent is prepared by mixing equal vols. of aq. KNO_2 (500 g. per l.) and buffer solution (NaOAc 450 g. or KOAc 325 g. and AcOH 100 c.c. per l.). More conc. KNO_2 makes the test more sensitive but causes interference by Ca. The same reagent also gives brown squares with Pb salts. J. W. S.

Sensitivity of the carbonate test for lithium. E. R. CALEY and A. L. BAKER, jun. (Ind. Eng. Chem. [Anal.], 1939, **11**, 101—102).—At room temp. the carbonate test for Li is too insensitive for practical purposes, but at 100° 3 mg. of Li can be detected as a white cryst. ppt. by adding 1 ml. of $2N$-Na_2CO_3 to 1 ml. of test solution. By means of a micro-technique, in which pptn. of other salts during evaporation is avoided, a few tenths of a mg. can be detected. The other alkali metals do not markedly interfere with the test, but NH_4 salts must be absent. Other interfering cations can be removed by pptn. at ~0° with the equiv. amount of aq. Na_2CO_3. Although not so sensitive as tests based on pptn. as aluminate, arsenate, fluoride, phosphate, stearate, or triple uranyl acetate, the carbonate test is the most selective for Li. L. S. T.

Microscopical detection of rubidium in the presence of cæsium. H. A. FREDIANI and L. GAMBLE (Mikrochem., 1939, **26**, 25—27; cf. A., 1938, I, 534).—Treatment of the test solution (1 drop) with 0·5% aq. naphthol-yellow S (1 drop) yields a ppt. of yellow needles in presence of ≮3 mg. of $Rb^{.}$ per ml. The presence of HCl, H_2SO_4, or HNO_3 prevents the pptn., but AcOH and HCO_2H have no effect. $Hg^{..}$ $Tl^{.}$, $Sn^{....}$, $Ag^{.}$, $Pb^{..}$, and $Cu^{..}$ also form ppts. with the reagent and mask the presence of $Rb^{.}$, but in the absence of these ions Rb can be detected in presence of ≯230 times its wt. of Cs. J. W. S.

Microchemical detection and determination of silver with the aid of filter-papers impregnated with reducing solutions. N. D. COSTEANU (Mikrochem., 1939, **26**, 170—174).—Test papers are prepared by immersing strips of filter-paper in $Fe^{III}NH_4$ citrate, $NHPh·NH_2$, quinol, gallic acid, gum arabic, tannin, pyrogallol, CH_2O, starch, $Na_2S_2O_4$, $K_2Cr_2O_7$, etc., and these are spotted with a series of $AgNO_3$ solutions of known concn. The intensity of stain produced varies with the reagent used and yields a series of comparison scales. After separation of other metals the Ag in the sample under test is converted into $AgNO_3$, diluted to a definite vol., and spotted on the test strips. The resultant spots are matched on the comparison strips. J. W. S.

Photometric micro-determination of silver. H. G. KRAINICK (Mikrochem., 1939, **26**, 158—164). —The Ag salt is brought into solution as $AgNO_3$ in 90% EtOH. The sample (4 c.c.) is cooled in ice in a darkened flask and 0·1% K_2CrO_4 (6 c.c.), also cooled in ice, is added rapidly with vigorous shaking. The colour of the colloidal solution produced is compared immediately in a photometer with the colour of a mixture of 90% EtOH (4 c.c.) and K_2CrO_4 (6 c.c.), utilising an S47 filter. The Ag content is determined from a standardisation curve. The method can be applied to the determination of 25 μg. of Ag. J. W. S.

Electro-analysis with small amounts of substance. II. Determination of silver. F. HERNLER and R. PFENINGBERGER (Mikrochem., 1938, **25**, 208—216).—Using the apparatus described previously (A., 1937, I, 47) and the conditions now detailed, comparative data show that the determination of small amounts of Ag (≮50 μg.) is best effected from ammoniacal or H_2SO_4 solution. The results obtained with cyanide solutions are subject to larger errors and the determination can be carried out with much less

certainty. Excess of KCN must be avoided, CNO′ must be absent, and the KCN must be freshly-prepared. $(NH_4)_2SO_4$ is preferred as electrolyte. Results obtained from HNO_3 solution are satisfactory, and the error is generally positive. L. S. T.

Systematic synthesis of atomic groups in analytical chemistry. III. Reactions of the silver affinity group, :C·NH·C:. J. V. DUBSKÝ, V. ŠINDELÁR, and V. ČERNÁK (Mikrochem., 1938, 25, 124—142).—The pptn. and colours of certain metal salts of rhodanine (Ag, Cu, Hg, Pb), 2 : 4-dihydroxy-thiazole (Ag, Cu, Hg), ψ-thiohydantoin (Ag, Hg), 2-thiohydantoin (Ag), 5-p-dimethylaminoanilorhodanine (Ag), rhodanine-red (Ag), 5-p-dimethylaminoanilo-2-thiohydantoin (I), 5-cyclohexanone-2-thiohydantoin (Ag, Pb, Hg, Cu, Cd, Mn, Co, Ni, Zn), and 5-p-di-methylaminobenzylidene-2-thiohydantoin (II) (Ag, Pb, Hg, Cu, Cd, Co, Mn, Mg) are described. In many cases, analyses of the compounds are given. (I) gives with $AgNO_3$ a violet ppt. (limiting sensitivity 1·2 μg. of Ag), with Hg salts a blue ppt. (0·2 μg. of Hg), and with Cu salts a very dark violet ppt. (0·15 μg. of Cu). Zn salts react only after 12 hr. With (II) in ammoniacal solution Ag˙ gives an orange-red ppt. (0·9 μg. of Ag), and Hg¨ a carmine-red ppt. (0·2 μg. of Hg). Only the group S:C·NH·C:O can be regarded as the active Ag affinity group. L. S. T.

Oximino-N-phenyl-3-methylpyrazolone as a reagent in analytical chemistry. V. HOVORKA and V. SÝKORA (Coll. Czech. Chem. Comm., 1939, 11, 70—76).—Characteristic reactions of an aq.-EtOH solution of the reagent with solutions containing Ag˙, Hg₂¨, Hg¨, Pb¨, Cu˙, Cu¨, Bi‴, Cd¨, Fe¨, Fe‴, Mn¨, Ni¨, UO₂¨, or Zn¨ are described. Salts of the composition $M(C_{10}H_8N_3O_2)_2$, where M = Cu, Zn, Mn, or UO₂, have been isolated. E. S. H.

Microchemical tests for Ag˙, Hg˙, Hg¨, Tl˙, Pb¨, and W. L. A. MICHELETTI (Rev. Fac. Cienc. Quím. La Plata, 1937, 12, 97—102).—Using p-di-methylaminobenzylidenerhodanine (I) 0·7 μg. Ag˙ can be detected in presence of W (9000), Hg˙ (7000), Tl˙ (7500), or Pb¨ (7500 μg.). In a solution containing Ag˙, Tl˙, Hg˙, and Pb¨ in addition to 6000 μg. W, it is possible to detect 8 μg. Tl˙ as TlI, 3 μg. Ag˙ using (I), 12 μg. Hg˙ with diphenylcarbazone (II), and 15 μg. Pb¨ with various reagents. 2 μg. Hg˙ in presence of 12,000 μg. Ag˙ can be detected by oxidation with Br in H_2O followed by (II). F. R. G.

Calcium oxalate monohydrate as a weighing form for calcium. E. B. SANDELL and I. M. KOLTHOFF (Ind. Eng. Chem. [Anal.], 1939, 11, 90—93).—CaC_2O_4 has been pptd. under different conditions and the suitability of this method of weighing Ca tested. When pptd. from neutral, ammoniacal, or acid solution, CaC_2O_4,H_2O retains excess of H_2O (0·3—1%) after air drying at room temp. Pptn. from HCl solution with neutralisation by aq. NH_3 gives high (~0·75%) results, and the excess of H_2O is not removed by keeping the ppt. over conc. H_2SO_4. Drying at 105° gives results closer to the theoretical, but excess of H_2O may still be retained, const. wt. is not always attained easily, and the ppt. may lose monohydrate H_2O in a dry atm. Pptn. of CaC_2O_4 in

the cold in presence of AcOH by the sudden addition of $(NH_4)_2C_2O_4$ gives a ppt. containing a high % of the di- and tri-hydrates, which are unstable in hot solution. Digestion near the b.p. for 20 hr. gives relatively perfect crystals of CaC_2O_4,H_2O which retain only a small excess of H_2O, but the small size of the crystals makes filtration slow. A better method of obtaining CaC_2O_4,H_2O containing little excess of H_2O consists in pptn. by the method of Willard and Chan, in which the HCl solution is gradually neutralised by the slow hydrolysis of $CO(NH_2)_2$. The solution containing 5 ml. of conc. HCl per 200 ml. is treated with 5 g. of $CO(NH_2)_2$ and digested at 80—90° until alkaline (Me-orange). The ppt. is washed with H_2O and finally $COMe_2$, and dried in air. With 0·2—0·5 g. of $CaCO_3$ results are accurate to ~0·2%, but with 0·05—0·1 g. of $CaCO_3$ they tend to be high. In presence of Na˙ or Mg¨ re-pptn. is necessary. L. S. T.

Accelerated analysis of Portland cement clinker, Portland cement, and basic slag.—See B., 1939, 266.

Qualitative separations on a micro-scale. Separations in the alkaline-earth group. A. A. BENEDETTI-PICHLER, W. R. CROWELL, and C. DONAHOE (Ind. Eng. Chem. [Anal.], 1939, 11, 117—120; cf. A., 1938, I, 269, 275).—The procedure of Noyes and Bray has been applied to the analysis of Ba, Ca, Sr, and Mg, starting with 1·2 mg. of non-metallic material or 0·6 mg. of metals and alloys. The details given of apparatus and technique are similar to those described previously (A., 1937, 1, 264). The pptns. are facilitated by using the vibrating armature of an ordinary door bell. Ba is confirmed as $BaSO_4$, Sr as a triple nitrite (?) of Sr, Cu, and K, Ca as $CaSO_4,2H_2O$, and Mg as $MgNH_4PO_4,6H_2O$, each of which is recognised from microscopical examination of its cryst. form. Limits of identification are 0·1, 0·1, 0·04, and 0·001 μg., respectively. L. S. T.

Determination of magnesium in aluminium alloys.—See B., 1939, 277.

Spectrographic methods of trace analysis. J. S. OWENS (Ind. Eng. Chem. [Anal.], 1939, 11, 59—63).—A review of the applications and technique of these methods for the detection and determination of trace elements (<0·01%). Representative trace analyses for metals in heavy chemicals, org. chemicals, Zn, Pb, Mg, body-fluids and tissues, and plant ash are discussed. L. S. T.

Potentiometric determination of zinc oxy-chloride in zinc chloride.—See B., 1939, 260.

Microchemical detection of lead. C. MAHR (Mikrochem., 1939, 26, 67—71).—A drop of the test solution is evaporated to dryness and treated with 2N-HNO_3 (1 drop) and powdered $CS(NH_2)_2$ is added. In presence of Pb thin rod-like prisms of $2Pb(NO_3)_2,11CS(NH_2)_2$ are formed which are readily differentiated microscopically from the hexagonal prisms of $CS(NH_2)_2$. The method permits the detection of 0·02 μg. of Pb in presence of 60—100 times its wt. of other metals. Large amounts of Ag should be removed prior to the test by pptn. with Cu or Ni. Very large amounts of Ag, Cu, or Bi can be removed

by electrolysis for 5 min. at 3·2 v. and 0·2 amp., using Pt electrodes. The sensitivity of the test can be increased by depositing the Pb anodically and using the anode washings for the test.   J. W. S.

Simplification of polarographic methods by the introduction of " step-quotients." H. E. FORCHE (Mikrochem., 1938, **25**, 217—224).—The difficulties introduced into polarographic analysis by changes in η of the solution, the drop velocity of the Hg cathode, and the drop capillaries can be eliminated by using the " step-quotient " method in which a similar ion of suitable depolarisation potential is added in a fixed concn. to the solution under investigation to serve as a reference substance. In the determination of Pb, a fixed amount of Cd is added, polarograms are taken with different Hg levels, and the mean val. of the ratio Pb : Cd is obtained from the measured potential steps. The [Pb] is found from a linear calibration curve determined by using solutions with increasing [Pb] and the same amount of Cd as used in the unknown. The mean val. of the ratio Pb potential change : Cd potential change is independent of the Hg drop level, η of the solution, and the diameter of the Hg cathode capillary.
                                                            L. S. T.

Rapid volumetric determination of small quantities of lead in blende.—See B., 1939, 260.

Rapid determination of the distribution of lead in aluminium and aluminium alloys.—See B., 1939, 277.

2 : 4-Dinitro-α-naphthol (Martius-yellow) as a microchemical reagent for thallous and cobaltous ions. A. MARTINI (Mikrochem., 1938, **25**, 9—12).—A solution of Martius-yellow (I) in aq. C_5H_5N (1 : 3) gives orange-yellow needles in sheafs or stellate clusters with $Tl^{\cdot}$; limiting sensitivity 0·04 μg. of Tl, and limiting concn. 1 in 10^5. (I) can also be detected by the addition of saturated aq. $TlNO_3$. $CoCl_2$ gives an amorphous ppt. which changes to orange-yellow rosettes and finally short prisms with (I). Limiting sensitivity and concn. are 0·5 μg. and 1 in 10^4, respectively. Ni salts do not react, and by means of (I) Co can be detected in presence of 100 times as much Ni. Photomicrographs are reproduced. Morphine and yohimbine hydrochlorides and quinine sulphate give amorphous ppts. with (I).   L. S. T.

Spectrographic micro-determination of copper. L. H. ROGERS (Ind. Eng. Chem. [Anal.], 1939, **11**, 47—48).—In the procedure described Sn or Cd is used as internal standard, the graphite electrodes are purified by the method of Standen and Kovach (Proc. Amer. Soc. Test. Mat., 1935, **35**, II, 33), and the reagents, most of which contained Cu, by the use of basic Mg carbonate (Steinberg, A., 1936, 382), one treatment removing Cu more effectively than 10 recrystallisations. The average error of the method is ∼5%. Prevention of the penetration of solution into the electrodes by means of kerosene or paraffin introduces contamination by Cu.   L. S. T.

Gravimetric determination of copper. P. SPACU (Z. anal. Chem., 1939, **115**, 423—425).—The neutral or slightly acid Cu solution (100—150 c.c. per 0·032 g. of Cu) is treated with 0·5 g. of NH_4NO_3 and

excess of C_5H_5N, heated at 30—40°, and then a considerable excess of cold conc. aq. $K_2Cr_2O_7$ or $(NH_4)_2Cr_2O_7$ is added. After cooling, the pptd. $Cu(C_5H_5N)_4Cr_2O_7$ is collected, washed first with H_2O containing 3 g. of $(NH_4)_2Cr_2O_7$ and 3 g. of C_5H_5N per l., then with C_5H_5N (0·5—1 c.c.) in $COMe_2$ (100 c.c.), and finally with Et_2O, and is dried in a vac. The method gives complete separation of Cu from Mn.   J. W. S.

[Use of] urobilin in the identification of small quantities of copper and mercury. C. A. SAGASTUME and V. OLIVA (Rev. Fac. Cienc. Quím. La Plata, 1937, **12**, 43—45).—The method of Bertrand and de Saint-Rat (A., 1936, 1221) is improved by extracting the Cu–urobilin complex with $CHCl_3$ whereby the substance is conc. and the colour intensified and brightened, but the colour is not sp. for Cu, being given also by >0·001 mg. Hg in 10 c.c. and the reaction can be used to identify Hg in absence of Cu.
                                                            F. R. G.

Determination of small amounts of heavy metals in natural waters. E. ABRAHAMCZIK (Mikrochem., 1938, **25**, 228—241).—A measured vol. of the H_2O is passed through a column of Permutit at the place of sampling. Adsorbed ions are subsequently displaced by the slow passage of saturated aq. NaCl through the column, and then analysed by the usual methods. 1 g. of Neopermutit is equiv. to 1 mg. of cation to be adsorbed. Tests on 10 l. containing 0·0025 mg. of $Fe^{\cdot\cdot}$ per l. showed a 90% recovery of the $Fe^{\cdot\cdot}$. Specially prepared adsorptive $[CO(NH_2)_2\text{--}CH_2O]$ resins can replace the Permutit. Details for the collection, separation, and determination of Cu, Zn, and Pb in natural H_2O by means of dithizone (I) are given. (I) in CCl_4 is shaken with 0·5 l. of the H_2O, and the Cu, Zn, and Pb dithizonates formed are treated with N-HCl which decomposes the last two. The unchanged Cu compound is determined colorimetrically. The Zn and Pb compounds are repptd. by NH_3 and (I). The CCl_4 phase is divided into two portions, one of which is treated with NH_4CN to decompose the Zn compound, and the other with $(NH_4)_2S$ to decompose the Pb compound. These metals are then determined colorimetrically. Test data and the heavy metal contents of Badgastein thermal H_2O are recorded.   L. S. T.

Polarographic analytical processes.—See B., 1939, 278.

Acridine complexes in micro-analysis. A. LANGER (Mikrochem., 1938, **25**, 71—81; cf. A., 1930, 882; 1938, I, 213).—With aq. NH_4CNS and 1% acridine hydrochloride solution or acridine in 0·5N-H_2SO_4, nitrate solutions of the following ions give ppts. sparingly sol. in dil. mineral acids : $Hg^{\cdot\cdot}$, yellow needles of $Hg(CNS)_4,H_2(C_{13}H_9N)_2$ (0·5 μg.); $Bi^{\cdot\cdot\cdot}$, orange-yellow plates of $Bi(CNS)_6,H_3(C_{13}H_9N)_3,6H_2O$ (2 μg.); $Cd^{\cdot\cdot}$, yellow needles of $Cd(CNS)_4,H_2(C_{13}H_9N)_2$ (∼10 μg.); $Cu^{\cdot\cdot}$, brown needles of $Cu(CNS)_2,H(C_{13}H_9N)$ (5 μg.); $Co^{\cdot\cdot}$, greenish-brown needles of $Co(CNS)_4,H_2(C_{13}H_9N)_2,3H_2O$ (5 μg.); $Fe^{\cdot\cdot\cdot}$, dark-red prisms of $Fe(CNS)_6,H_3(C_{13}H_9N)_3$; $UO_2^{\cdot\cdot}$, light-yellow spheres of $UO_2(CNS)_4,H_2(C_{13}H_9N)_3,4H_2O$ (2 μg. of UO_2); $Zn^{\cdot\cdot}$, yellow ppt. of $Zn(CNS)_4,H_2(C_{13}H_9N)_2$ (0·01 μg.). Limiting sensitivities are given in paren-

theses. Photomicrographs are reproduced. The colours given by Co$^{..}$ and Cu$^{..}$ permit the use of these tests also as drop reactions on filter-paper. The application of the above pptns. to the identification of the ions concerned by microscopic examination is difficult and limited in its scope. The following compounds have also been pptd: $HgI_2,HI,C_{13}H_9N$; $BiI_4,H(C_{13}H_9N),H_2O$; $CdI_4,H_2(C_{13}H_9N)_2,3H_2O$; $BiBr(OH)_2,C_{13}H_9N$; $CdBr_2,HBr,C_{13}H_9N$; $HgCl_2,HCl,C_{13}H_9N$; and $BiCl_4,HC_{13}H_9N$.

L. S. T.

Determination of mercurochrome.—See B., 1939, 325.

Iodometric determination of potassium mercuri-iodide.—See A., 1939, II, 134.

Two new specific reactions for cerium. E. HERZFELD (Z. anal. Chem., 1939, **115**, 421—423).—The green coloration with benzidine (Feigl, A., 1920, ii, 55) is sp. for Ce and permits detection of 62 µg. in 2 c.c. With tannin in 50% glycerol, Ce yields a blue-violet Tyndall cone, and with carminic acid in a saturated solution of NH_4OAc in 50% glycerol it yields a reddish Tyndall cone. These reactions are both sp. and permit the detection of 8 µg. Ce. 16 µg. Ce can be detected by the yellow colour and white Tyndall cone produced on treatment with H_2O_2 in 50% glycerol. J. W. S.

Aluminium-alizarin reaction in microchemistry and its application in the detection of the aluminium cation. O. R. CHIODI (Rec. Fac. Cienc. Quím. La Plata, 1937, **12**, 117—119).—6·7 µg. Al$^{...}$ may be identified in presence of Fe (800), Co (3960), Zn (3010), Ni (2889), Mn (2674), or U (11,460 µg.) by co-pptn. with Fe$^{...}$ by means of $(NH_4)_2CO_3$ and NH_3. Similarly Al$^{...}$ in presence of F' may be identified by co-pptn. with Fe$^{...}$ by means of NH_4Cl and NH_3. The Al$^{...}$ is then identified by Feigl's method, which may also be used for Ce, Y, Pr, and Nd. F. R. G.

Oxidation of ferrous iron with potassium iodate. B. SINGH (J. Indian Chem. Soc., 1938, **15**, 615).—Amounts of $FeSO_4,(NH_4)_2SO_4,6H_2O$ between 0·0580 and 0·7830 g. can be determined by potentiometric titration against KIO_3 in presence of HCl in an atm. of CO_2 with an error $\not>0·0004$ g. F. R. G.

Detection of iron and uranium by means of drop reactions. E. A. KOCSIS (Mikrochem., 1938, **25**, 13—15).—The addition of a 0·2% alcoholic solution of quercetin (I) or quercitrin (II) to a moist drop containing Fe^{II} or Fe^{III} produces on filter-paper an olive-green spot or ring; limiting sensitivity, 0·3 µg. of Fe per 0·025 c.c. $UO_2^{..}$ gives a rust-coloured spot or ring; limiting sensitivity, 3 µg. per 0·025 c.c. Conc. acids or highly-coloured cations interfere to some extent. The colours are stable on drying. Fe and U together form a grey colour. AsO_4''', AsO_3''', Cu$^{..}$, Zn$^{..}$, and $NH_4^{.}$ give bright lemon colours, but the test is less sensitive in these cases. The reaction with U can be used for the detection of $\not<3$ µg. of (I) or (II). L. S. T.

Determination of iron in raw materials for glass.—See B., 1939, 262.

Photocolorimetric determination of ferrous iron in natural phosphates.—See B., 1939, 260.

Determination of free acid in solutions of ferric salts.—See B., 1939, 260.

Determination of iron in chromiferous ferrites.—See B., 1939, 273.

Rapid photometric determination of iron and manganese in aluminium and its alloys.—See B., 1939, 277.

Ultra-violet spectrum analysis of alloy steels.—See B., 1939, 274.

Spectro-analytical investigation of steels, using the spark spectrum.—See B., 1939, 274.

Analysis of Prussian-blue.—See B., 1939, 292.

Electrolytic separation of cobalt from nickel by deposition as cobaltic oxide. S. TORRANCE (Analyst, 1939, **64**, 109—111).—Co_2O_3 is deposited on the anode from a solution buffered to p_H 5 with AcOH and NaOAc, deposition of Co on the cathode being prevented by use of a Sand revolving-diaphragm electrode (cf. B., 1937, 352). In the method of determining Ni in alloys described previously (B., 1938, 1176) Co is co-pptd. The combined deposit is dissolved in HNO_3 and Co determined separately as described above. E. C. S.

Oxamidedioxime. I. Determination of nickel. R. CHATTERJEE (J. Indian Chem. Soc., 1938, **15**, 608—610).—$[C(NH_2):N·OH]_2$ (I) (A., 1889, 1142, 1163) with slightly ammoniacal $NiCl_2$–NH_4Cl gives the Ni derivative, $C_4H_{10}O_4N_8Ni$, of (I), which may be used to determine gravimetrically 0·006 g. of Ni, in presence of Zn, Mg, or, adding NH_2OH,HCl, of small amounts of Co. E. W. W.

Polarographic determination of nickel in special steels.—See B., 1939, 274.

Application of the conductometric method to the simultaneous determination of molybdic acid and ammonia in ammonium molybdates. (MME.) Z. SOUBAREW-CHATELAIN (Compt. rend., 1939, **208**, 88—90).—The resistance curve for titration of an NH_4 molybdate with NaOH shows two sharp breaks corresponding with neutralisation of MoO_3 and complete displacement of NH_4 by Na, respectively. The use of the method is illustrated by application to NH_4 molybdates of known composition. A. J. E. W.

Determination of tin in ores.—See B., 1939, 275.

Determination of vanadium by activated catalysis. L. SZEBELLÉDY and M. AJTAI (Mikrochem., 1939, **26**, 87—94).—The solution under test (1 c.c.) is treated with 0·1% p-phenetidine in HCl (1 c.c.) and freshly prepared 1% aq. pyrocatechol (1 c.c.), and diluted to 4 c.c. After mixing, exactly 1 c.c. of 5% aq. $KBrO_3$ is added and a portion of the solution introduced into the absorption cell of a Krumholz microphotometer (A., 1936, 1223) fitted with a green filter; the time required for the galvanometer deflexion to move 50 scale divisions is observed. Two methods of calculating the [V] from the results are detailed. 0·0006 µg. of V can be determined by this method. J. W. S.

Activation of the catalytic reactions of vanadium with 8-hydroxyquinoline. L. SZEBELLÉDY and M. AJTAI (Mikrochem., 1939, 26, 75—86).—The catalytic action of V on the reactions of NH_2Ph (in H_2SO_4) with $KClO_3$, of p-$NH_2 \cdot C_6H_4 \cdot OH$ with $KClO_3$, of p-phenetidine with $KClO_3$, $KBrO_3$, and KIO_4, of dianisidine with KIO_4, and of α-$C_{10}H_7 \cdot OH$ + p-$C_6H_4(NH_2)_2$ with $KClO_3$ is promoted by 8-hydroxyquinoline. Optimum conditions for utilising these reactions for the detection of V are described, and the limiting concns. detectable by the various methods are recorded. J. W. S.

Activation of the catalytic action of vanadium with pyrocatechol. L. SZEBELLÉDY and M. AJTAI (Mikrochem., 1939, 26, 72—74).—The catalytic effect of V on the reaction between p-phenetidine (I) and $KBrO_3$ is activated by pyrocatechol. To utilise this effect in the detection of V, the sample is treated with 1% aq. pyrocatechol (1 c.c.), 0·1% (I) in HCl (1 c.c.), and saturated aq. $KBrO_3$ (1 c.c.). After a few min. the solution turns violet if V is present, whilst a blank comparison solution should remain colourless. The method is capable of detecting 0·0005 µg. of V. $Ag^{\cdot}$, $Pb^{\cdot\cdot}$, and $Fe^{\cdot\cdot\cdot}$ interfere with the test, but can be removed with NaCl, Na_2SO_4, and $NaHF_2$, respectively. J. W. S.

Activation with potassium hydrogen tartrate of the catalytic reaction of vanadium. L. SZEBELLÉDY and M. AJTAI (Mikrochem., 1938, 25, 258—262).—V catalyses the reaction between p-phenetidine and $KClO_3$. The addition of K H tartrate activates the reaction and increases the sensitivity from 1 to 0·0001 µg. 1 c.c. of 0·1% HCl solution of p-phenetidine, 1 c.c. of saturated aq. $KClO_3$ or 0·5 c.c. of saturated aq. $KBrO_3$, and 0·05 g. of K H tartrate are added to the test solution, the mixture is diluted to 5 c.c., and heated on the water-bath. A violet colour is produced when V is present. When $KBrO_3$ is substituted for $KClO_3$ the limiting sensitivity is 0·001 µg. of V. Data showing the behaviour of the tests in presence of many foreign ions are tabulated. $Pb^{\cdot\cdot}$ interferes, and must be removed by addition of 0·1 g. of Na_2SO_4, and $(NH_4)_2SnCl_6$ prevents the detection of V by these tests. $Fe^{\cdot\cdot\cdot}$ interferes with the test when $KClO_3$ is used, and must be removed by means of 0·05 g. of NaF. I' interferes with the test when $KBrO_3$ is used. L. S. T.

Determination of vanadium in agglomerates and ores.—See B., 1939, 276.

Qualitative analysis of the arsenic–tin group. N. LÖVGREN (Svensk Kem. Tidskr., 1939, 51, 2—3).—Sb is detected in presence of excess of Sn^{IV} by pptn. with H_2S in presence of H_3PO_4 and conc. HCl. Sn^{IV} remains in solution as a complex with H_3PO_4. M. H. M. A.

Determination of antimony, bismuth, and gold in copper by the logarithmic sector method.—See B., 1939, 274.

Iodometric determination of gold. L. BRÜLL and F. GRIFFI (Annali Chim. Appl., 1938, 28, 536—541).—Aq. $AuCl_3$ ($\not>2$ mg. of Au) is treated with 0·1% KI and the liberated I is titrated with 0·01N-$Na_2S_2O_3$ (1 c.c. $\equiv$ 1·97 mg. of Au). The method depends on the reaction $AuCl_3 + 3KI = 3KCl + AuI + I_2$. F. O. H.

Use of mercurous chloride for the separation, detection, and estimation of easily-reduced elements. G. G. PIERSON (Ind. Eng. Chem. [Anal.], 1939, 11, 86—88).—The use of HgCl for the separation, detection, and recovery of easily-reducible elements is discussed. Details for the separation of the constituents of a mixture of Au, Pd, Pt, Se, Te, and As, based on selective pptn. with HgCl under increasing acid concn. (up to 28% HCl), are given. Ru, Rh, Ir, and Os are not pptd. by HgCl. I' is pptd. as HgI in neutral or slightly acid solutions. The colours produced on the HgCl by these elements under controlled conditions serve for their detection, and the shades of colour for their estimation. When working with 0·1 mg. of element, the accuracies obtainable are Au ± 3, Pt ± 5, Pd ± 3, Se ± 5, Te ± 10, As ± 5, and I' ± 5%, respectively, and the min. amounts visible on 0·1 g. of HgCl are 0·05, 0·1, 0·05, 0·2, 0·5, 0·005, and 3 µg., respectively. The method is unusually free from interference. Coloured solutions do not interfere, but appreciable amounts of NO_3', per-salts, free halogens, $SnCl_2$, and hypophosphites must be absent. The oxidising action of $Cu^{\cdot\cdot}$ and $Fe^{\cdot\cdot\cdot}$ may interfere when high concns. of these ions are present. Colloids such as starch, dextrin, casein, blood, etc. do not interfere. L. S. T.

[Analysis of] platinocyanides. H. ETIENNE and A. DE RASSENFOSSE (Bull. Soc. chim. Belg., 1938, 47, 818—822).—Attempts at quant. analysis of platinocyanides by distillation with H_2SO_4, reduction with Zn, chlorination, ignition, and fusion with S and Na_2CO_3 all failed, but good results were obtained by pptn. of $Ag_2[Pt(CN)_4]$, followed, after filtration, by back-titration of the excess of $Ag^{\cdot}$. The presence of $Mg(NO_3)_2$, to reduce adsorption of $AgNO_3$ on the ppt., is an advantage. F. J. G.

Indication lag in thermometers. F. LIENEWEG (Arch. Wärmewirts., 1939, 20, 52—54).—The errors introduced by inertia in thermometer readings taken during sudden temp. changes are discussed. Simple diagrams from which the indication lag in a given medium, e.g., steam, can be calc. are given. R. B. C.

Stirring arrangement for tubular electric ovens. B. P. FEDOROV and A. L. CHODAK (J. Appl. Chem. Russ., 1938, 11, 1238—1239).—Apparatus is described. R. T.

Inexpensive small constant-temperature bath. M. VAISBERG (J. Lab. clin. Med., 1939, 24, 415—416). C. J. C. B.

Attainment of low temperatures by pumping liquid helium II. B. S. BLAISSE, A. H. COOKE, and R. A. HULL (Physica, 1939, 6, 231—239).—The attainment of temp. below 0·8° K. by pumping liquid He is facilitated by so designing the apparatus as to reduce as far as possible the loss of liquid by "creeping." 0·76° K. has been reached by pumping 2·5 c.c. of gas per min. The efficacy of the magnetic method of further lowering the temp. is thereby improved. L. J. J.

Apparatus for determining calorific value of fuels.—See B., 1939, 234.

B.-p. elevation. I. Apparatus for the study of aqueous solutions with non-volatile solutes. R. P. Smith (J. Amer. Chem. Soc., 1939, **61**, 497—500).—Apparatus for measuring b.p. elevation, with a reproducibility of $\pm 0.0002°$, of aq. solutions at pressures of 150—760 mm. is described.   E. S. H.

Determination of Curie point temperature by high-frequency resistance. J. M. Bryant and J. S. Webb (Rev. Sci. Instr., 1939, **10**, 47—48).—The Curie point and other μ-0 relationships are obtained satisfactorily from the high-frequency R-0 curve, so eliminating the lengthy calculations of μ. Frequencies of 400 kc. per sec. are used. Advantages of the method over the ballistic method are that a special furnace is not required, continuous observation of variation in μ especially near the Curie point can be made, and very small quantities of ferromagnetic materials may be measured. A disadvantage is that determination is not possible over as wide a range of ϕ densities as those possible with other methods.
F. H.

Photo-electric methods in analytical chemistry. R. H. Müller (Ind. Eng. Chem. [Anal.], 1939, **11**, 1—17).—A review of methods, apparatus, and applications, with extensive bibliography.
L. S. T.

Photo-electric cell. G. Déchène (Compt. rend., 1939, **208**, 95—97).—The cell consists of a layer of HgO in contact with a transparent anode (Cellophane impregnated with H_2SO_4) and a Hg cathode. The cell has a high time-lag and low stability, but is suitable for qual. uses.   A. J. E. W.

Properties of a selenium barrier-layer [photo-] cell with the " ballistic " method of measurement. H. König (Helv. Phys. Acta, 1936, **9**, 602—610; Chem. Zentr., 1937, i, 534).—Inconsistencies are minimised by the use of a ballistic method and dark intervals between measurements.   A. J. E. W.

Spectrophotometric methods in modern analytical chemistry. S. E. Q. Ashley (Ind. Eng. Chem. [Anal.], 1939, **11**, 72—79).—A review of the various types of instrument available, and the errors, limitations, advantages, and applications of these methods.   L. S. T.

Use of the infra-red in the study of minerals. R. Bailly (Bull. Acad. roy. Belg., 1938, [v], **24**, 791—822).—Constructional and operational details are given for an apparatus for the near infra-red study of opaque minerals. Data are recorded for Sb_2S_3 and MoS_2.   W. R. A.

Compensation process for qualitative spectral analysis. S. Lindroth and E. Elvegård (Naturwiss., 1939, **27**, 78).—In the compensation process described all the lines of the carrier element are eliminated from the photometer diagram, leaving only those of the impurities it is wished to detect.   A. J. M.

Experimental rulings. (A) L. C. Martin. (B) E. E. Jelley (J. Roy. Microscop. Soc., 1938, [iii], **58**, 239—242, 242—243).—(A) Results of an examination of some specimens, prepared by the late H. J.

Grayson, of rulings on realgar films mounted on glass are described.

(B) Mounting medium squeezed from under the cover glass of an unfinished film examined for birefringence/optical thickness gave results corresponding with those for orthorhombic S, suggesting that the Canada balsam mounting had been saturated with S in order to avoid stripping of the film.   N. M. B.

New light source for thermal excitation. E. Baum (Ann. Physik, 1939, [v], **34**, 377—388).—A flame for the thermal excitation of spectra in which, owing to catalysis by MgO, the band spectrum is entirely absent at the point of observation is described. With 60 sec. exposure Rb and Cs can be detected in concn. 10^{-4}N.   O. D. S.

Curved-crystal ionisation spectrometer for X-rays. S. T. Stephenson (Rev. Sci. Instr., 1939, **10**, 45—46).—By mounting an ionisation chamber behind a slit moving in the focal cylinder of a curved-(mica) crystal spectrograph the intensity of the Mo $K\alpha_1\alpha_2$ doublet is $>$ is obtained in the usual Bragg spectrometer for a given resolving power.   F. H.

Photomicrography in colour. W. F. Chubb (Metallurgia, 1939, **19**, 113—115).—An adaptation of the Dufay colour process to metallurgical requirements is described. Photographs can be obtained at a magnification of 1200 diameters.   P. G. McC.

Colour analysis. A. G. de Almeida (Mikrochem., 1939, **26**, 1—8).—Theoretical.   J. W. S.

Present status of colorimetry. M. G. Mellon (Ind. Eng. Chem. [Anal.], 1939, **11**, 80—85).—A review dealing mainly with the most important types of instrument now in use for colorimetric measurements in chemical analysis.   L. S. T.

Hydrogen electrode for p_H micro-determinations. H. A. Frediani (Ind. Eng. Chem. [Anal.], 1939, **11**, 53).—An apparatus for determining p_H on vols. ranging from 5 to 60 cu.mm. is described. Vals. obtained between p_H 2·4 and 10·2 agreed with those given by a Hildebrand-type electrode on larger vols.   L. S. T.

Conductivity measurements by means of a heterodyne method. E. Guggolz (Z. Elektrochem., 1939, **45**, 229—235).—An apparatus and technique which at the same time are applicable to the measurement of dielectric consts. are described. The method is relative, $PhNO_2$ being recommended as the reference liquid. The method is successfully applied to conductometric titrations.   C. R. H.

Cyclotron and its applications. J. D. Cockroft (J. Sci. Instr., 1939, **16**, 37—44).—A review dealing with the principle and construction of the cyclotron, the technique of using it, and its application as a generator of neutrons for physical and biological work, for the production of large quantities of the radioactive forms of common elements, and for the production of highly energetic charged particles.
A. J. M.

Capillary ion source for the cyclotron. M. S. Livingston, M. G. Holloway, and C. P. Baker. (Rev. Sci. Instr., 1939, **10**, 63—67).—The capillary discharge source successfully used in direct acceleration

apparatus has been adapted to the cyclotron. It has the advantage over the normal filament source of ions of producing a conc. beam of ions of high intensity which can effectively be isolated from the cyclotron chamber.   F. H.

Extinction of thyratron tubes by alteration of grid potential. K. S. LION (Helv. Phys. Acta, 1939, **12**, 50—54).—The discharge in thyratron tubes can be extinguished by alteration of grid potential. The lower is the anode current (lower anode potential, higher resistance in anode circuit) the lower are the extinction potentials. With high anode current extinction becomes impossible.   A. J. M.

Thyratron counter for measurement of radiation. T. B. RYMER (J. Sci. Instr., 1939, **16**, 84—87).—In a radiation integrator in which ionisation currents are led into a condenser which discharges through a thyratron relay operating a telephone counter on reaching a certain potential, the circuit is reset by a purely electrical arrangement, avoiding time-lags associated with mechanical relays used in earlier devices. The instrument operates on a.c. mains.   L. J. J.

Geiger point counters. B. DASANNACHARYA and A. C. SETH (Phil. Mag., 1939, [vii], **27**, 249—257; cf. A., 1937, I, 267).—The influence of the resistances in the counter circuits on the functioning of a point counter, particularly on the max. rate at which counts can be recorded from sources placed axially to the counter, has been examined at a no. of voltages and pressures.   L. J. J.

Separation of light positive and negative ions by attainment of a single sign in charged air currents. P. MERCIER and G. JOYET (Bull. Soc. vaud. Sci. nat., 1936, **59**, 109—118; Chem. Zentr., 1937, i, 797).—Two similarly charged air currents are passed separately through electric fields directed similarly to and against the currents, respectively, the field strengths being inversely $\propto$ the ionic mobilities. The issuing currents contain equal densities of ions of opposite sign.   A. J. E. W.

Recording of electron-diffraction patterns. J. J. TRILLAT (Compt. rend., 1939, **208**, 507—508).—A solarised image free from secondary X-ray fogging on development is obtained by using exposures of several min. Exposures >1 hr. give a brown image on the undeveloped emulsion.   A. J. E. W.

Cataphoresis apparatus.—See A., 1939, III, 420.

Modification of the schlieren method for use in electrophoretic analysis. L. G. LONGSWORTH (J. Amer. Chem. Soc., 1939, **61**, 529—530).—Modified procedure is outlined.   E. S. H.

New method of measuring intensities of magnetisation. B. H. SCHULTZ (Physica, 1939, **6**, 137—144).—A magnetometric method, in which a pair of parallel annular coils turns about a horizontal axis in a homogeneous horizontal magnetic field, is described. The substance under observation is placed inside one of the coils, and the currents in the separate coils are adjusted until the resultant couple vanishes. The system is calibrated with a substance of known susceptibility.   L. J. J.

Arrangement for electrometric micro-volumetric analysis. P. KRUMHOLZ (Mikrochem., 1938, **25**, 244—246).—Contamination of the solution under investigation is avoided by the use of a siphon. Comparison electrodes of Ag–AgCl filled with saturated aq. KCl and closed by a sintered-glass plate are satisfactory, and show changes in potential $\not> 2$—3 mv. over a period of several months. A semi-automatic micro-burette, fitted with interchangeable ground-joint tips in order to control the size of drops and to facilitate cleaning, is described. During titration, stirring is effected by rotating the titration vessel.   L. S. T.

New forms of micro-volumetric apparatus. P. KRUMHOLZ (Mikrochem., 1938, **25**, 242—243).—Micro-pipettes of 0·25—2 c.c. capacity, in which contamination from the finger or from saliva is avoided by means of an adapter, are described. Measuring flasks of 2 c.c. and of 5—25 c.c. capacity are illustrated. They can, with advantage, carry on the stem three marks corresponding with known differences of vol.   L. S. T.

Burettes suitable for electrometric micro-titrations. I. J. MIKA (Mikrochem., 1938, **25**, 109—123).—Data concerning the performance of a burette with an upper tap, of the type described by Benedetti-Pichler (A., 1928, 500), and one with a levelling tube, of the type described by Flatt (A., 1935, 189), are recorded and discussed. The latter type gives accurate vals. and permits the use of 0·1—0·2N. solutions in the titration. The use of the former type is advisable only when the highest accuracy is not required.   L. S. T.

Prevention of sticking of burette stopcocks. E. E. MACZKOWSKE (Ind. Eng. Chem. [Anal.], 1939, **11**, 20).—Sticking is prevented by keeping the stopcock immersed in distilled H_2O.   L. S. T.

Mercury control for capillary burettes. D. L. JOHNSON and C. L. SHREWSBURY (Mikrochem., 1939, **26**, 143—146).—A plunger type of control for the Rehberg burette utilises leather packing boxes to make all connexions Hg-tight. The control can support a Hg column >4 ft. high without leakage and still affords minute control over the rise of Hg in the capillary.   J. W. S.

Micro-burette. N. G. HEATLEY (Mikrochem., 1939, **26**, 147—149).—In the simple form of micro-burette described the liquid column is balanced by a negative pressure controlled by Hg reservoirs. In titration use is made of the fact that when under moderate pressure, owing to the surface tension, liquid leaves the burette tip only when this is immersed in the liquid under titration. A simple mechanism for raising and lowering the titration table so as to effect this control is described.   J. W. S.

Drainage of viscosimeters and pipettes. G. JONES and E. FERRELL (J.C.S., 1939, 325—332; cf. A., 1937, I, 584).—The conclusion that, for a given surface and vol. of viscosimeter or pipette, the total vol. of after-drainage $\times$ outflow time $\propto$ the kinematic viscosity of the liquid is now shown to be independent of γ of the liquid by experiments with H_2O, 1·46N-KCl, MeOH, and Bu^{a}OH. The error due to

incomplete drainage in viscosimeters and pipettes, and the advantages of pipettes having the shape of a double cone over cylindrical and spherical pipettes, are discussed.   F. H.

Development of laboratory technique. P. P. WULFF (Chem. Fabr., 1938, **11**, 432—435).—A review of progress in constructional materials and technique, based on the exhibits at Achema VIII.
                                                R. C. M.

Production of crystals for physical measurements. R. JOUAN (Compt. rend., 1939, **208**, 206—207).—Uniform growth of seed crystals is obtained in an oscillating silk bag immersed in the slightly supersaturated solution.   A. J. E. W.

Suction plant for fume cupboards. L. C. JANSE (Chem. Weekblad, 1939, **36**, 85).—Fumes are removed by blowing a jet of air into a vertical earthenware pipe to prevent corrosion of the fan blades.
                                                S. C.

Dropping apparatus for high-pressure and laboratory work. H. VOLLBRECHT and F. GEILSDORF (Chem. Fabr., 1938, **11**, 549—551).—An apparatus for introducing drops of liquid into apparatus in which reactions are being carried out at high pressure is described.   A. J. M.

Differential manometer for the measurement of small pressure differences. G. RUDOLPH (Z. Physik, 1939, **111**, 535—536).—Pt bolometer wires are mounted in each of two similar vessels. A small current is passed through the wires in series; small differences in pressure between the two vessels result in a difference in resistance of the two wires which is determined with a Wheatstone bridge and galvanometer. The apparatus is used as a differential manometer in discharge tube investigations.
                                                H. C. G.

Automatic high-pressure regulator. H. BRENDLEIN (Chem. Fabr., 1938, **11**, 440).—An electromagnetically controlled needle reducing valve is operated by a contact manometer through a relay with a Hg switch.   R. C. M.

Gas generators. R. J. BROOKS (J. Chem. Educ., 1939, **16**, 27).—Two glass bottles, one containing acid and the other the solid reactant, are fitted with stoppers and suitable glass tubing, and connected in an inverted position. Generation and flow of gas are controlled by means of pinch-cocks.
                                                L. S. T.

Simple gas generator. W. SEIDEL (Chem. Fabr., 1938, **11**, 408—409).—An apparatus providing a regular stream of gas by the interaction of two liquids is described. Its capabilities are described in connexion with the prep. of HCl from conc. H_2SO_4 and conc. HCl.   A. J. M.

Hydrogen sulphide generator. E. E. CHANDLER (J. Chem. Educ., 1939, **16**, 34).   L. S. T.

Jena apparatus glasses and new apparatus prepared from them for distillation, stirring, p_H determination, and filtration. P. H. PRAUSNITZ (Chem.-Ztg., 1939, **63**, 109—112).—The chemical and thermal properties of the new Jena apparatus glasses are described. Various new forms of flasks, distillation apparatus, plates for drop analysis,

colorimeter tubes, stirring apparatus, glass electrodes, funnels, and filters manufactured in these glasses are described and illustrated.   J. W. S.

Simplified method of preparing microscopic glass spheres. K. SOLLNER (Ind. Eng. Chem. [Anal.], 1939, **11**, 48—49).—O_2 laden with powdered glass is projected through a flame on to a surface of H_2O. Perfect spheres, free from internal strain, of ∼0·5—50 μ. diameter are formed.   L. S. T.

Apparatus for micro-sublimation. B. L. CLARKE and H. W. HERMANCE (Ind. Eng. Chem. [Anal.], 1939, **11**, 50—53).—Details of an apparatus for sublimation over longer periods are described and illustrated.   L. S. T.

Determination of density differences by the flotation temperature method. M. RANDALL and B. LONGTIN (Ind. Eng. Chem. [Anal.], 1939, **11**, 44—46).—Details of construction and manipulation of an apparatus in which the flotation temp. is determined to within 0·005° in a 0·1-ml. sample are given. The calculation of ρ and composition from these temp. is discussed, and the design of a special slide-rule for calculating % composition from the flotation temp. is indicated.   L. S. T.

Hygroscopic substances in micro-analysis. I. New techniques for drying and weighing solids. II. Liquids. H. K. ALBER (Mikrochem., 1938, **25**, 47—56, 167—181).—I. Three types of hygroscopicity are differentiated according to no. of μg. increase in wt. per min. that occurs when 5 mg. of the substance are placed on the microchemical balance (cf. Hayman, A., 1932, 921; 1938, I, 161). A glass charging tube with ground-on cap, and a metal rack for holding two of these tubes in the Abderhalden dryer, are described. With this apparatus accurate H_2O determinations can be made, even with highly hygroscopic substances, by the procedure detailed. The technique of transference and weighing of a dried sample for the determination of N by the Dumas micro-method, and of C and H, and a routine method for the ultimate analysis of hygroscopic solids are detailed. The above procedures are illustrated by determinations on hygroscopic substances of biological origin.

II. Six drying procedures, viz., cg. procedures in micro-centrifuge cones, in capillaries, and in distilling flasks, and mg. procedures with and without distillation, and with a weighing bottle, depending on the amount and nature of the liquid, and on the drying agent, are described. The efficiencies of these procedures are shown by data for the % of C, H, or N determined before and after the addition of 5—10% of H_2O to liquids of known purity. A simple technique for the automatic filling of weighing capillaries with practically complete exclusion of atm. H_2O is described. Factors, such as evaporation, adsorption by the drying agent, and surface attraction, which lead to loss of material in micro-procedures for drying have been investigated. The use of $KClO_3$ in the determination of S by Pregl's adsorption method may lead to low results.   L. S. T.

Indicator of carbon monoxide in shafts.—See B., 1939, 260.

Ultrafiltration. III. M. AMAT and J. DUCLAUX (J. Chim. phys., 1938, **35**, 379—386; cf. A., 1937, I, 584).—Filters having pores of diameter 0·02 μ. may be prepared by the deposition of successive thin layers of carborundum of graded particle size on a layer of sintered glass. Methods of determining porosity of such filters are described. The advantages of SiC over collodion filters are stability and extremely low adsorption as shown by experiments with several solutions of dyes.   F. H.

Automatic pouring device for [use in] filtrations. O. JÄNTTI (Suomen Kem., 1939, **12**, A, 35—36).—A device for ensuring a continuous feed of liquid to the filter is described.   M. H. M. A.

Tube process for separation of liquids. K. CLUSIUS and G. DICKEL (Naturwiss., 1939, **27**, 148—149).—The process involving thermo-diffusion and thermo-siphon action used for the separation of gases (A., 1939, I, 211) can be applied to liquids under suitable conditions. 0·1N-NaCl gave in 4 hr. a 3·6-fold increase of concn. at the " heavy " end with a temp. difference between the walls of 80°. A selective concn. would be expected in solutions of several electrolytes. A $COMe_2$–H_2O mixture containing originally 42·2 mol.-% $COMe_2$ gave, after 6 hr. and a temp. difference of 40°, a concn. of 6·2 mol.-% $COMe_2$ at the " heavy " end. In spite of the low mol. wt. of H_2O it becomes conc. at the heavy end, thus confirming the association of H_2O. A mixture of H_2O and D_2O was also partly separated. A. J. M.

Modification of Astruc's apparatus for hot extraction. A. ASTRUC, J. GIROUX, and A. BARTHE (J. Pharm. Chim., 1939, [viii], **29**, 145—148).—An improved apparatus is described in detail.
                    W. O. K.

Effect of certain impingement dust sampling instruments on the dust particles. E. L. ANDERSON (J. Ind. Hyg., 1939, **21**, 39—47).—Various types of impingement sampling apparatus were attached to a dust chamber and the particle size distribution was compared with the original sample of dust and with a settled sample. The instrument counts showed a higher proportion of fine particles. Comparison of particle counts with the calc. no. of particles in the chamber showed that the instruments gave a higher count than actually existed. It was concluded that impingement fractured the larger particles.
                    E. M. K.

Air-driven ultracentrifuge for molecular sedimentation. J. BISCOE, E. G. PICKELS, and R. W. G. WYCKOFF (J. Exp. Med., 1936, **64**, 39—45).—Constructional details are given.   CH. ABS. (e)

Electric micro-Kjeldahl heating stand. LABORATORY STAFF, DARTINGTON HALL TRUSTEES (J.S.C.I., 1939, **58**, 80).—The construction of a heating stand for 6 micro-Kjeldahl flasks from Al angle, asbestos sheet, infusorial earth insulating blocks, and nichrome V wire is described and illustrated.

Glass liner for high-pressure hydrogenation bomb. E. B. HERSHBERG and N. WEINER (Ind. Eng. Chem. [Anal.], 1939, **11**, 93).—A glass container of 10—30 c.c. capacity, which is satisfactory for lining high-pressure hydrogenation bombs, is described and illustrated.   L. S. T.

Pirani gauge. M. SCHÉRER (Compt. rend., 1939, **208**, 426—427).—Thermo-electric effects are minimised by immersing the gauge and Wheatstone bridge in liquid N_2. The balancing resistance is a second similar gauge, the ratio arms being of Ni ribbon. A 10 mm. deflexion of the light-spot is produced by a pressure change of 10^{-7} mm. (air).
                    A. J. E. W.

Dropping funnel for use at high pressures. V. M. GALAK (J. Appl. Chem. Russ., 1938, **11**, 1239—1241).—The pressure above the liquid in a dropping funnel is equalised with that in the flask by means of a side-tube.   R. T.

Apparatus for production of gaseous ammonia. M. A. POPOV (J. Appl. Chem. Russ., 1938, **11**, 1237—1238).—Apparatus is described.   R. T.

Determination of the distribution of pore-sizes in a porous body. N. A. FIGUROVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 453—456).—The method described depends on measurement of the rate of displacement of a liquid from the porous body when it is immersed in a second liquid. A formula relating the rate of displacement to the pore-size is given, and measurements of the displacement of Et_2O from charcoal by EtOH are recorded.
                    J. A. K.

Simple Knudsen manometer. S. WERNER (Z. tech. Physik, 1939, **20**, 13—16).   O. D. S.

Micro-extraction apparatus and separating funnel. B. L. BROWNING (Mikrochem., 1939, **26**, 54—55).—An extractor in which the condensed solvent drips into a fritted glass funnel containing the material to be extracted is described. The apparatus is suitable for analysis of specks isolated from pulp and paper. The separating funnel comprises a small bulb connected at the upper end to a tube 5 mm. in diameter and at the lower end to a bent capillary tube. Liquids are introduced into or removed from the funnel by suction or pressure applied to the wider tube.   J. W. S.

Apparatus for conducting reactions and extractions in special atmospheres. F. W. VAN STRATEN and W. F. EYRET (Mikrochem., 1939, **26**, 56—58).—An apparatus made from standard equipment which permits the extraction of mixtures of metals with their oxides with aq. NH_3 in an atm. of NH_3 is described. Tests show that Cu and Zn are practically unattacked by the NH_3 under these conditions. The use of the apparatus in the determination of S as Ag_2SO_4, formed on the surface of Ag pellets, is suggested.   J. W. S.

Electrically-driven magnetically-supported vacuum-type ultracentrifuge. J. W. BEAMS and S. A. BLACK (Rev. Sci. Instr., 1939, **10**, 59—63).—The ultra-centrifuge described is supported by means of an electro-magnet and is capable of precise speed control.   F. H.

Spherical ground joints for vacuum systems. S. M. RUBENS and J. E. HENDERSON (Rev. Sci. Instr., 1939, **10**, 49—50).—A spherical or ball-and-

socket ground joint, suitable for prep. of an asymmetric Langmuir probe for exploration over a limited region within a metal discharge chamber, is described. The use of a spherical ground joint for prep. of a multiple-way stopcock is also described.　　F. H.

Determination of internal volume of steel capillaries for measurements with gases. J. KAMINSKY and B. E. BLAISDELL (Rev. Sci. Instr., 1939, **10**, 57—58).—The internal vol. of steel capillaries, obtained from measurements of mass and ρ of contained Hg, is 3—6% < that found by the gas expansion method, which is the correct vol. to use for measurements with gases. The smaller val. with Hg is explained by the effect of scale on the walls, and by fissures in the walls not being filled with Hg. The internal vol. of glass capillaries is the same whether determined by the Hg or gas expansion methods.
　　　　　　　　　　　　　　　　　　　　　F. H.

Simple Couette viscosimeter with thermostat device ; experiments on the influence of an electric field on the viscosity of anisotropic liquids. Y. BJÖRNSTÅHL and O. SNELLMAN (Kolloid-Z., 1939, **86**, 223—230).—Apparatus for η measurements at high temp. is described. η of p-azoxyphenetole at different field strengths has been determined and a relation derived.　　E. S. H.

Theory of the fractionation of gaseous mixtures by diffusion. Characteristics of the Hertz mercury-vapour pump. E. BLUMENTHAL (Phil. Mag., 1939, [vii], **27**, 341—369).—A simplified theory of the coeff. and the velocity of fractionation of Hertz's apparatus for the fractionation of isotopic gases by diffusion into a stream of Hg vapour is developed, assuming streamline motion of the vapour. The theory explains the decrease in rate of fractionation at high velocities of the vapour stream. The

min. of fractionation, observed under certain experimental conditions at moderate velocities of the vapour stream, is due to perfectly regular aërodynamic effects ; means of overcoming these effects are given. The influence of the geometrical dimensions of the apparatus, and the pressure and the diffusion coeff. of the gas in the apparatus, on the coeff. and rate of fractionation is discussed.　　D. F. R.

Vacuum distillation. B. L. DUNICZ (Ind. Eng. Chem. [Anal.], 1939, **11**, 28).—An apparatus for collecting fractions without interrupting the distillation or contaminating the fraction with grease is described.　　L. S. T.

Micro-distillation apparatus with receiver for distilling under reduced pressure. S. A. SHRADER and J. E. RITZER (Ind. Eng. Chem. [Anal.], 1939, **11**, 54—55).—Details of an all-glass apparatus for distilling liquids (0·5—2 g.) of high b.p. are given. The receiver permits collection of several fractions of the distillate without interrupting the pressure under which distillation is performed. Tests on a 1 : 1 mixture of octoic acid and *iso*amyl salicylate are recorded.　　L. S. T.

[Laboratory] experiment on liquid–vapour equilibrium for a two-component system. A. A. VERNON (J. Chem. Educ., 1939, **16**, 20—21).—Details for determining the b.p.–composition diagram for the system H_2O–HCO_2H are given.　　L. S. T.

Justus Liebig, May 14th, 1803—April 18th, 1873. E. BERL (J. Chem. Educ., 1938, **15**, 553—562).　　　　　　　　　　　　　　　　　　L. S. T.

Methods of fire-making used by early man. W. N. WATSON (J. Chem. Educ., 1939, **16**, 36—45).—Numerous methods are described and illustrated.
　　　　　　　　　　　　　　　　　　　　　L. S. T.

Geochemistry.

Chemical and physico-chemical analysis of sulphuretted water of Mariori (Salerno). C. LA ROTONDA and G. PETROSINI (Annali Chim. Appl., 1938, **28**, 513—524).—Data are tabulated and discussed.　　　　　　　　　　　　　　F. O. H.

Oceanographic investigations of Bering Sea and Bering Strait. C. A. BARNES, T. G. THOMPSON, and F. A. ZEUSLER (Trans. Amer. Geophys. Union, 1935, 258—264).—The $[PO_4''']$ and $[SiO_3'']$ in the surface waters are ≫ in southern portions of the N. Pacific, but NO_2' vals. were normal. O_2 and NO_2' vals. are correlated. Nutrient salts were, in general, in lower concns. in the southern waters of the N. Pacific.　　　　　　　　　　　　CH. ABS. (e)

Cause of the high acidity in natural waters, especially in brines. L. G. M. BAAS BECKING (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 1074—1085).—The high acidity of natural waters is attributed to geochemical and biological factors.
　　　　　　　　　　　　　　　　　　　　　W. R. A.

Lake Mosher. V. I. NIKOLAEV and N. E. SALISCHTSCHEVA (J. Appl. Chem. Russ., 1938, **11**, 1233—1236).—Analytical data are recorded. The high B_2O_3

content of the tributaries of the lake suggests the presence of B deposits in their vicinity.　　R. T.

Variability in mineral composition of the water of certain rivers of the U.S.S.R. F. F. SELIVANOV (J. Appl. Chem. Russ., 1938, **11**, 1197—1216).—Analytical data are recorded.　　R. T.

Strontium as a chemical indicator [of the origin of certain natural brines]. V. I. NIKOLAEV and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 465—466).—Brines derived from Permian salt deposits contain >0·02% Sr, whilst concns. <0·01% are characteristic of Caspian deposits.
　　　　　　　　　　　　　　　　　　　　　J. A. K.

Benld meteorite, Illinois No. 2. B. H. WILSON (Science, 1939, **89**, 34—35).—The wt., 1770·5 g., the sp. gr., 3·69, and the appearance indicate this meteorite to be a typical aërolite.　　L. S. T.

Gases in rocks, and related problems. E. S. SHEPHERD (Amer. J. Sci., 1938, [v], **35**, A, 311—351). Analyses of volcanic gases and gases obtained from lavas are recorded. In all cases the gases contain a

preponderance of H_2O (about 80%); notable amounts of rare gases or hydrocarbons are absent. E. S. H.

Genesis of iron deposits on the right bank of the Red River (Tonkin). J. H. HOFFET (Compt. rend., 1939, **208**, 112—114). A. J. E. W.

Titaniferous magnetites of the San Gabriel Mountains, Los Angeles Co., California. W. W. MOORHOUSE (Econ. Geol., 1938, **33**, 737—748).— Microscopical investigation of the titaniferous magnetite ores, which are composed mainly of titaniferous magnetite, pyroxene, and apatite, indicates a late magmatic or deuteric origin rather than pyrogenetic. L. S. T.

Origin and genesis of the Oxford iron ore of Neuvizy (Ardennes). A. BONTE (Compt. rend., 1939, **208**, 452—454). A. J. E. W.

Classification and nomenclature of igneous rocks. II. F. LOEWINSON-LESSING (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 129—133).—The parallelism of intrusive and effusive rocks is considered in connexion with the andesites and trachytes. The essential difference between andesites and basalts lies in the fact that the former are neutral rocks derived from a basic magma. They may be termed apomagmatic in distinction to basalt which is orthomagmatic. Trachytes should not be parallelised with syenites, which are not derived from a syenitic magma, but from an acid or basic magma by processes of assimilation or differentiation. The origin and genetic connexions of the syenites are discussed. The origin of the high Na content of spilites is considered. A. J. M.

Albite trends in rocks of the Piedmont. E. INGERSON (Amer. J. Sci., 1938, [v], **35**, A, 127—141).— The albite trends in the Port Deposit granodiorite complex and associated rocks are not relict structures, but are controlled by the lattice of the felspar grains. E. S. H.

Evidence of the intrusion temperature of peridotites. R. B. SOSMAN (Amer. J. Sci., 1938, [v], **35**, A, 353—359).—Experiments on heating a coke inclusion in peridotite and analysis of the inclusion for H, O, and N indicate that the max. temp. reached by the coke was 440—520°. The intrusion temp. of the peridotite was probably $\ngtr 600°$. E. S. H.

Concentration of the less familiar elements through igneous and related activity. E. G. ZIES (Amer. J. Sci., 1938, [v], **35**, A, 385—404).—A review. E. S. H.

Lavas of the African Rift Valleys and their tectonic setting. N. L. BOWEN (Amer. J. Sci., 1938, [v], **35**, A, 19—33).—Analytical results indicate many exceptions to the general tendency towards preponderance of K in the Western Rift and Na in the Eastern Rift. The lack of definite relations between lava chemistry and tectony in the Rift Valleys is emphasised. E. S. H.

Mineralogical study of the French coast of Somaliland. E. A. DE LA RÜE (Compt. rend., 1939, **208**, 291—292).—Basaltic and rhyolitic deposits rich in zeolites, calcite, and siliceous minerals are described. Cu, Au, and Mn also occur. A. J. E. W.

Existence of pleochroic halos in certain gneisses from the Algerian Massif, and its geological consequences. L. ROYER (Compt. rend., 1939, **208**, 448—450).—The occurrence of 0·03-mm. halos is described and discussed. It is deduced that the rocks are of primary origin (possibly pre-Cambrian), and that their temp. has not exceeded 600—800°. A. J. E. W.

Rare metal mineralisation in the S.E. part of mountainous Altai. G. D. AFANASIEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 47—49).— Co-Ni mineralisation is developed in zones of hydrothermal alteration of schists up to 1—2 m. thick impregnated with Co and Ni sulphoarsenides. Cobaltite, smaltine, erritrine, annabergite, chalcopyrite, arsenopyrite, and ilmenite, associated with ankerite, quartz, chlorite, tourmaline, fluorite, scapolite, actinolite, biotite, muscovite, and apatite, are found. W—Mo mineralisation is found in the scarn zone of the Atuurgol intrusion as molybdenite, scheelite, chalcopyrite, pyrrhotine, arsenopyrite, and rarely Au, together with garnet, epidote, scapolite, diopside-gedenbergite, vesuvianite, orthite, calcite, etc.; the Mo content is 0·07% and W 0·03%. Ta occurs as columbite associated with tourmaline, black Li mica, and fluorite. F. J. L.

Physicochemical properties of Indian bentonites. I. N. C. SEN-GUPTA (J. Indian Chem. Soc., 1938, **15**, 559—565).—Seven bentonites were examined with reference to composition, base saturation capacity and exchangeable cations, swelling, thixotropy, and vol. and velocity of sedimentation in distilled H_2O. C. R. H.

Crystallographic studies of sulpho-salts: baumhauerite, meneghinite, jordanite, diaphorite, freieslebenite. C. PALACHE [with W. E. RICHMOND and H. WINCHELL] (Amer. Min., 1938, **23**, 821—836).—Crystallographic data for baumhauerite, $Pb_4As_6S_7$, $a : b : c = 1·3687 : 1 : 0·9472$, β 97° 17', are recorded. Meneghinite, $a : b : c = 0·4736 : 1 : 0·1715$, has (X-ray) a_0 11·29, b_0 23·78, c_0 4·12 A., giving a ratio for $a_0 : b_0 : c_0$ in agreement with the above. The vol. of the unit cell is 1103 A.³, giving 4162 for the mol. wt. The formula $Pb_{13}Sb_7S_{23}$ should replace the accepted formula $Pb_4Sb_2S_7$. Jordanite, ρ 6·32, has $a : b : c = 0·2354 : 1 : 0·1397$, β 93° 53', with (X-ray) a_0 7·529, b_0 31·87, c_0 4·421 A., β 93° 59'; the vol. of the unit cell is 1058·1 A.³, giving a mol. wt. of 4103·2. The formula $Pb_{14}As_7S_{24}$ or $Pb_{13}As_7S_{23}$ should replace the accepted formula $Pb_4As_2S_7$. New morphological data recorded for diaphorite from Freiberg give $a : b : c = 0·4953 : 1 : 0·1840$. A Weissenberg study gives a_0 15·83, b_0 32·23, c_0 5·89 A., vol. of the unit cell 3007 A.³, and mol. wt. 10,879 ($\rho_{obs.}$ 5·97); space-group D_{2h}^{21} (Cmma). The formula is $Ag_3Pb_2Sb_3S_8$ with 8 mols. per unit cell. Freieslebenite, $Ag_5Pb_3Sb_5S_{12}$, from Hiendelencina, Spain, has $a : b : c = 0·5871 : 1 : 0·9277$, β 92° 14', a_0 7·53, b_0 12·79, c_0 5·88 A., vol. of unit cell 567 A.³, mol. wt. 2145; space-group C_{2h}^5 (P2₁/n). L. S. T.

Coexistence of tungsten and gold in the mineralised zone of Salsigne-Villanière (Aude). H. VINCIENNE (Compt. rend., 1938, **207**, 1114—1115). —A general review. W. R. A.

A., I.—General, Physical, and Inorganic Chemistry

MAY, 1939.

Intensity ratios of Stark effect components of hydrogen lines. II. Influence of conditions of excitation on the intensity ratios. N. RYDE (Z. Physik, 1939, **111**, 683—707; cf. A., 1938, I, 336).—Theoretical. A continuation of earlier work.
L. G. G.

Astrophysical consequences of metastable levels in hydrogen and helium. O. STRUVE, K. WURM, and L. G. HENYEY (Proc. Nat. Acad. Sci., 1939, **25**, 67—73).—The influence of electron pressure on the lifetime of the metastable levels $2S$ of H_2 and 2^1S of He is shown to be sufficient to account for the observation of absorption in the spectra of the Orion nebula of lines arising from the latter but not from the former level.
O. D. S.

High-frequency glow discharge in hydrogen excited through internal electrodes. G. W. FOX and N. T. BURDINE. **High-frequency glow discharge with internal electrodes.** N. T. BURDINE (Iowa State Coll. J. Sci., 1938, **13**, 21—26, 52—53). —The effect of pressure and frequency on the intensity in the Balmer series excited by alternating fields of λ 6—32 m. has been examined. For each line there is an optimum pressure and one or more favourable frequencies of excitation.
L. J. J.

Nitrogen forbidden line $2P \rightarrow 4S$ in the auroral spectrum. R. BERNARD (Physical Rev., 1939, [ii], **55**, 511).—The corr. λ of the line previously reported (cf. A., 1938, I, 423) is 3466·5±1 A., in good agreement with the val. 3466·6 A. deduced from the ionisation potential 14·48 v. of N_I. The results of other investigators are discussed.
N. M. B.

Polarisation of the green line (5577·3 A.) in the light of the night sky. I. A. CHROSTIKOV (Compt. rend. Acad. Sci. U.R.S.S., **21**, 322—324).—The at. O line, 5577·3 A., in the light of the night sky from the region of the Pole star is found to be polarised to the extent of about 12%. This is contrary to the photo-chemical theory of Chapman.
H. C. G.

Spectrum of argon IV. A. B. RAO (Indian J. Physics, 1938, **12**, 399—405).—The spectrum of A IV has been extended into the visible and near ultra-violet. Prominent terms due to the $4p$, $4d$ configuration have been detected and about 30 lines have been newly classified.
W. R. A.

Explosion luminosities. H. MURAOUR, A. MICHEL-LÉVY, and J. ROUVILLOIS (Compt. rend., 1939, **208**, 508—510).—Flashes of high luminosity are obtained by detonation of shattering explosives in A; much lower intensities are observed in air, He, and CO_2. Detonation is essential, normal combustion of the explosive giving low luminosities in all the

above gases. Experiments with a Vieille " erosion bomb " indicate that the occurrence of spectrum lines originating from a conical metal orifice (cf. A., 1938, I, 378) is not due to a simple erosion effect.
A. J. E. W.

Sodium-like spectra of potassium, calcium, and scandium. P. G. KRUGER and L. W. PHILLIPS (Physical Rev., 1939, [ii], **55**, 352—357; cf. A., 1938, I, 165).—Identifications and classifications of K IX, Ca X, and Sc XI lines are tabulated. Calc. and observed second differences are compared, and are shown to depend, to a first approximation, only on the total quantum nos. of the initial and final states. Application of the const. second difference law to ionisation potentials is indicated.
N. M. B.

Zeeman effect and Paschen–Back effect in powerful magnetic fields. P. L. KAPITZA, P. G. STRELKOV, and E. I. LAUERMAN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 326—327).—The magnetic separation of lines belonging to the principal sharp series and the subordinate series of Ca, Be, Zn, Cd, and Hg was investigated, using a field of 327 k-gauss Fields calc. from different lines on the same spectrogram give an equal field val. agreeing with independent electromagnetic observations. The anomaly formerly observed in the Zeeman effect with Zn was due to confusion of Zn and Cu lines. The initial stage of the Paschen–Back effect in the Zn triplet 2^3P—2^3S was observed in a field of ∼300 k-gauss. The effect was studied in the Be doublet π^2S—$2P$ (λ 3132 A.) up to 300 k-gauss, the observed splitting agreeing well with the calc. val.
A. J. M.

Forbidden lines of Fe VII in the spectrum of Nova RR Pictoris (1925). I. S. BOWEN and B. EDLÉN (Nature, 1939, **143**, 374).—$3d^2$ levels obtained from the vac. spark spectrum of Fe are tabulated. The calc. $\lambda\lambda$ of the forbidden transitions between these terms are also given; they correspond with lines of hitherto unknown origin in the visible spectrum of the late stages of Nova Pictoris.
L. S. T.

Effect of sodium, potassium, and lithium salts introduced into the flame on the intensity of the rubidium line. T. BOROVIK-ROMANOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 328—331).— Photographs of the 7947 and 7800 A. Rb lines from $COMe_2$ vapour–air flame source show a weakening in intensity on admixture of NaCl, NaBr, NaI, and LiCl with the Rb salts. KCl, NaF, and Na_2SO_4 produce a negligible effect. The degree of weakening is correlated with the heat of formation of the salt added.
L. G. G.

Zeeman effect with cæsium. S. E. FRISCH (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 327—328).— The Zeeman effect with the absorption lines of the principal series of Cs, Rb, and Na has been investigated. With the Cs I line λ 4593·2 A. and a field of 17,800 gauss, forbidden components were found near $\Delta\nu = \pm\frac{4}{3}\Delta\nu_0$ (π) and $\Delta\nu = \pm\frac{2}{3}\Delta\nu_0$ (σ), and for the line λ 4555·3 A. near $\Delta\nu = \pm\frac{5}{3}\Delta\nu_0$ (π) and $\Delta\nu = \pm\frac{1}{3}\Delta\nu_0, \pm\frac{9}{3}\Delta\nu_0$ (σ). Similar forbidden components were found with the lines Cs I λ 8521·1, Rb I λ 7800·3, and Na I λ 5889·96 A. They were not found with the K resonance lines, as the hyperfine structure is too narrow. Asymmetry in the position of some of the forbidden components, and in the intensity of the ordinary Zeeman components, was observed.
A. J. M.

Intensity of spectrum lines in the gas discharge. V. A. FABRIKANT (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 305—322).—The abs. intensities of spectral lines calc. on the basis of elementary at. consts. and electrical data coincide with the vals. obtained by experiment. The 1850 A. line plays an important part in the radiation of the low-pressure discharge in Hg. The quenching of spectral lines by collisions of the second kind has been quantitatively investigated. The low-pressure discharge radiation of Hg vapour is a black-body radiation. The factors determining the shape of lines in the high-pressure discharge have been examined.
A. J. M.

Continuous spectrum of mercury arc. W. ELENBAAS (Physica, 1939, **6**, 299—302).—The discrepancy between the measured intensity and that calc. by Unsöld's formula (A., 1938, I, 50) can be accounted for by the uncertainty of the data required for the calculation.
L. J. J.

Measurement of spectrum line intensities by the anomalous dispersion method. G. S. KVATER (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 301—304).—The anomalous dispersion of Tl vapour was investigated and the intensities (f) and transition probabilities for the lines 3776 and 5350 A. were obtained. f_{3776} and f_{5350} are 0·0414 and 0·435, respectively, using Wartenberg's data for the v.p. of Tl. An equation connecting v.p. with temp. over the range 612—1063° was obtained. The heat of vaporisation of Tl at 0° K. was calc. to be 43,300 g.-cal. The f vals. obtained are compared with those of other workers, and discrepancies are explained. Investigation of the distribution of Tl atoms in the $6^2p_{1/2}$ and $6^2p_{3/2}$ states shows that there is a Boltzmann distribution. Optical measurements give the ratio of the universal consts. $h/k = 4·82 \times 10^{-11}$.
A. J. M.

General solution for the equations of natural line breadth. L. SPITZER, jun. (Physical Rev., 1939, [ii], **55**, 361—364).—Mathematical. A rigorous solution of the Dirac radiation equations for a single radiative transition between two at. states gives formulæ valid for any appropriate variation with frequency both of density of light quanta and of the matrix component for the transition. The usual ∞ at high frequencies is eliminated naturally. Applications for an absorption or emission line are given.
N. M. B.

Primary characteristic of the Townsend discharge in rare gases. H. BÜTTNER (Z. Physik, 1939, **111**, 750—769).—The dependence of the slope of the characteristic, and its magnitude, on pressure and electrode separation in rare gases and their mixtures is examined.
L. G. G.

Sparking potentials at low pressures. R. B. QUINN (Physical Rev., 1939, [ii], **55**, 482—485).— A special tube is described by means of which sparking potentials were measured at gas pressures < the Paschen crit. val. on air, CO_2, H_2, and He up to 24 kv. with Ni electrodes, and on air with a stainless steel cathode. Results are compared with available data (cf. Cerwin, A., 1935, 138), and from the equations for the straight portions of the sparking potential curves the no. of electrons released by the cathode per positive ion impact is calc. by Dempster's method (cf. A., 1934, 1282).
N. M. B.

Transition from coronal discharge to other forms of electrical discharge in gases. N. A. KAPTZOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 441—452).—Experiments in air at room temp. and 1 atm., which confirm the author's theory of the dependence of sparking potential between concentric cylinders on their dimensions, are described.
L. J. J.

Ignition of the electric discharge in gas. G. A. TJAGUNOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 453—458).—Theoretical.
L. J. J.

Distribution of electron velocities in gas discharge tubes. B. I. DAVIDOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 464—466).—See A., 1938, I, 167.
L. J. J.

Study of plasma by the method of its disturbance by the magnetic field. G. V. SPIVAK and E. M. REICHRUDEL (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 479—494).—Interpretation of probe characteristics and the effect of magnetic fields on them are discussed.
L. J. J.

Limits of applicability of the theory of low-pressure plasma. B. N. KLARFELD (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 495—504).—The theory of Langmuir and Tonks gives agreement with experiment only at pressures <0·01 mm. Hg. The ionisation capacity of electrons is independent of the current at pressures ≯0·001 mm. Hg; at higher pressures it increases with the current.
L. J. J.

Some processes at discharge ignition in the gasotron. N. D. MORGULIS and M. D. GABOVITSCH (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 504—508). —The effects of feeding tension, pressure, and wall effects on the discharge potential of Hg gasotrons at high voltages have been examined. The ignition peak is found only where a negative charge can accumulate on the walls, and the peak diminishes with increasing pressure.
L. J. J.

Discharge in vapours of mercury at pressures above atmospheric. A. M. SOHEMAEV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 509—512).—Increased efficiency is shown to result from the use of super-high Hg pressure in lighting lamps.
L. J. J.

Variations in the colour of the night sky. R. GRANDMONTAGNE (Compt. rend., 1939, **208**, 754—755).—A curve showing the variation over a 21-month period of the ratio of the intensities in the spectral regions 5850—6800 and 5850—9000 A. is given; this curve illustrates the changes in the energy distribution at the red end of the spectrum.   A. J. E. W.

Red bands of cyanogen in the spectrum of the night sky. G. DÉJARDIN (Compt. rend., 1939, **208**, 751—753).—Bands in the sky spectrum are shown to correspond with superimposed systems of CN ($^2\Pi{\to}^2\Sigma$) and active N.   A. J. E. W.

Wave-lengths in the spectrum of Antares. D. N. DAVIS (Astrophys. J., 1939, **89**, 41—83).—λλ, intensities, and identifications of lines in the region 3600—6600 A. are tabulated.   L. S. T.

Excitation of nebular lines. J. KAPLAN (Nature, 1939, **143**, 164—165; cf. A., 1938, I, 590).   L. S. T.

Origin of type B coloration in the aurora borealis. R. BERNARD (Compt. rend., 1939, **208**, 824—826).—Six spectrograms of red auroral spectra (type B) show enhancement of the bands of the first positive system of N_2 in the yellow-red region in agreement with previous observations of Vegard, but contary to the conclusions of Harang.   W. R. A.

Atomic lines in the auroral spectrum. J. KAPLAN (Nature, 1939, **143**, 278—279).—A criticism (cf. A., 1938, I, 589).   L. S. T.

Law of interstellar absorption. O. A. MELNIKOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 329—330).—Comparison of the energy distribution in the spectra of near and distant stars indicates the presence of absorbing and scattering media in the interstellar space. The absorption coeff. (k) of the interstellar medium can be calc. $k \propto \lambda^{-1}$ for λλ in the photographic region, and $\propto \lambda^{-4}$ in the far infra-red.   A. J. M.

Sunspot spectra. H. D. BABCOCK (Proc. Nat. Acad. Sci., 1938, **24**, 525—527).—Using a spectrograph of dispersion ~2·4 A. per mm. and exposures times of 2 hr., sunspots have been photographed with Eastman 1Z plates hypersensitised with NH_3 over the range 10,000—11,200 A. Lines of the Paschen series of H_2 are weakened. The effects on lines of C, O, S, P, Mg, Si, Sr⁺, Ba⁺, Ca, Fe, Cr, Ni, and Ti are discussed. Cs lines were not observed. Some measurements in the ultra-violet to 3100 A. are discussed, particularly lines due to OH, NH, CN, Ni⁺, Ti, V, Cd, Rh, Rn, and Pd. There is no evidence of Tl.   W. R. A.

Photographs of the short-wave optical spectral lines with a bent crystal as grating. H. FLEMBERG (Z. Physik, 1939, **111**, 747—749).—By means of an X-ray spectrograph with a bent mica grating, converted for use with a spark source, five lines of λλ 16·807 A. (F VIII), 15·012 and 17·051 A. (Fe XVII), 18·497 A. (Cr XV), and 16·951 A. (intercombination in F spectra) have been photographed.   L. G. G.

Contact potential of nickel. R. C. L. BOSWORTH (Trans. Faraday Soc., 1939, **35**, 397—402; cf. A., 1937, I, 599).—Clean and smooth Ni surfaces are obtained by distillation on to an outgassed W filament, the thickness of the deposit being calc. from resistance measurements. V.p. of Ni between 1320° and 1540° K. are calc. A deposit of Na on the Ni behaves similarly to one on W, vals. of the dipole moment obtained from the contact p.d. being substantially the same as for Na on W. The work function (ϕ) of the Na on Ni is a min. when 0·6 of the surface is covered. For the Ni surface $\phi = 4\cdot96$ ev. at 300° K., increasing to 6·36 ev. after contact with O_2, which is immediately adsorbed. The Ni–NiO contact p.d. is −1·40 v.   F. L. U.

Lowering of breakdown potential for air at atmospheric pressure. C. BRINKMANN (Z. Physik, 1939, **111**, 737—746).—It is shown that the lowering in breakdown potential is dependent on the intensity of irradiation of the spark gap (to produce photo-ionisation), for small c.d., according to the Rogowski-Fucks law.   L. G. G.

Excitation potentials of mercury vapour. A. H. LEE and R. WHIDDINGTON (Proc. Leeds Phil. Soc., 1939, **3**, 509—514).—Excitation potentials of Hg vapour were measured by an impact method, using a beam of electrons at 190 v. Four crit. potentials were found below the ionisation limit and six above. The former have spectroscopic interpretations; the latter are discussed and an explanation involving excitation of an inner shell is advanced.   H. C. G.

Energy distribution in field emission. J. E. HENDERSON and R. K. DAHLSTROM (Physical Rev., 1939, [ii], **55**, 473—481).—The energy distribution for field-current electrons from W was obtained by the method of retarding potentials. The distribution shows that the greatest no. of electrons have energies very close to the max. energy obtained, and the range of energies is at least 10 v.   N. M. B.

Energy distribution of electrons emitted from a hot filament. F. I. WRIGHT (Proc. Leeds Phil. Soc., 1939, **3**, 526—531).—Electrons, scattered through a given angle, are magnetically focussed on to photographic film. The broadening of the resultant lines is wholly explicable by the energy distribution amongst the electrons.   L. G. G.

Spontaneous electron emission from electrodes and the field electron emission from thin layers of insulators as an after-effect of the discharge through gases. H. PAETOW (Z. Physik, 1939, **111**, 770—789).—Cf. A., 1938, I, 487.   L. G. G.

Radiation emitted on transformation of amorphous modifications of metals. J. KRAMER (Naturwiss., 1939, **27**, 108—109).—On transformation from the amorphous form metals emit radiation of λ 2—3 × 10⁻⁶ cm. The radiation can be detected by point counters, and occurs only for true amorphous layers. Reheating of the same layer fails to produce the effect. Amorphous surface layers produced on metals by mechanical treatment, which are identical with the amorphous forms produced by cathodic sputtering and chemical methods, also give the radiation. It produces photo-electrons in the layer, which in part leave the metal and cause ionisation in the surrounding air.   A. J. M.

Emission of secondary electrons from metals bombarded with protons. J. S. ALLEN (Physical Rev., 1939, [ii], **55**, 336—339; cf. Healea, A., 1936, 1041).—Results of investigations on Be, C, Al, Cu, Ni, and Pt are given. For non-outgassed metals the secondary electron–proton ratio for protons of energy 48—212 e.kv. was ~3, and for outgassed C, Cu, Ni, and Pt was ~2. Be gave a yield of ~7·5 electrons per proton. The secondary electron yield was $\propto$ cosec θ, where θ is the angle between the proton beam and the target. N. M. B.

Emission of secondary electrons under high-energy positive-ion bombardment. A. G. HILL, W. W. BUECHNER, J. S. CLARK, and J. B. FISK (Physical Rev., 1939, [ii], **55**, 463—470).—The yield of secondary electrons produced by high-energy positive ions (protons, H_2^+, and He^+) bombarding cold targets of Mo, Pb, Al, and Cu was measured in the range 43—426 kv. For protons the yield decreased from ~4 at low energies to ~2 at high energies. For H_2^+ the yields were ~6 and more nearly const. with energy. No marked dependence of yield on the kind of metal was found. The yield of secondaries from Mo bombarded with He^+ was ~13 and varied slowly with the energy. N. M. B.

Emission of negative ions from oxide cathodes. L. F. BROADWAY and A. F. PEARCE (Proc. Physical Soc., 1939, **51**, 335—348).—A beam of negative ions was detected in cathode-ray tubes by the darkening effect produced on the fluorescent screens of the tubes. Ions identified in the components of the beam are: $^1H^-$, $^{12}C^-$, $^{16}O^-$ (or $^{32}O^{--}$), $^{35}Cl^-$, $^{37}Cl^-$, $^{80}Br^-$, and $^{127}I^-$. Two other ions having mass/charge ratios of 26 and 42 are thought to be CN^- and CNO^-, respectively. The negative-ion current is of the order 10^{-9} amp., or ~10^5—10^6 times < the corresponding electron current. Results are discussed in connexion with various processes by which ions may be produced and conclusions relating to origins are given. N. M. B.

Formation of negative ions by negative-ion bombardment of surfaces: a new process. R. H. SLOANE and (Miss) E. B. CATHCART (Nature, 1939, **143**, 474—475).—The liberation of negative ions from a wire gauze inserted between the cathode and the first slit of a mass-spectrograph is reported. These negative ions result from the bombardment of the gauze by negative ions from the cathode and show excess energies. L. S. T.

Distribution of electron velocities in the plasma of discharge. S. I. PEKAR (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 467—474).—The effect of inelastic collisions in distorting the Maxwell distribution of electron energies is discussed. L. J. J.

Spatial distribution of visible radiation produced by fast electrons. P. A. TSCHERENKOV (Compt. rend. Acad. Sci. U.R.S.S., 21, 319—321).—The direction of emission of max. radiation produced by the passage of fast electrons from Th-C'' through H_2O, cyclohexane, C_6H_6, and Et cinnamate is in agreement with Frank and Tamm's theory. H. C. G.

Spectrum of visible radiation produced by fast electrons. P. A. TSCHERENKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 651—655).—The dependence on the λ of the energy of the visible radiation produced by fast electrons has been investigated for C_6H_6 in an apparatus which is described. Rn was used as the fast electron source. Data obtained confirm the linear relationship between the energy and $1/\lambda^3$ indicated by the theory of Tamm and Frank (cf. A., 1937, I, 220). W. R. A.

Energy of positive ions in plasma of gas discharge. L. A. SENA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 475—477).—Determinations of potential gradients and average energy of ions are described. L. J. J.

Theory of the ion current in the magnetron as applied to the production of [beams of] ions. M. M. SITNIKOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 513—518).—Theoretical. The effects of a no. of factors on the performance are calc. L. J. J.

Mass-spectrographic investigation of hydrogen and helium canal rays (H_3^+, H_2^-, HeH^+, HeD^+, He^-). J. W. HIBY (Ann. Physik, 1939, [v], **34**, 473—487).—D_3, D_2^-, HeH, and HeD cannot be identified. He^- was observed. The mean free path for decomp. of D_3^+ in D_2 is 8 cm. at 10^{-2} mm. The variation in strength of the H_3^+ parabola with the purity of the gas in the discharge tube has been investigated. O. D. S.

Scattering of fast β-particles by xenon nuclei. R. L. S. GUPTA (Proc. Physical Soc., 1939, **51**, 355—358).—In view of discordant available data, the nuclear scattering and energy loss of homogeneous fast β-particles of energy ~2 Me.v. was investigated in a cloud-chamber filled with $Xe-O_2$ mixture, a Rn source in conjunction with an electron lens being used. Results for the angular distribution of scattering are in agreement with Mott's formula. N. M. B.

Electron transfer in mercury vapour. F. L. ARNOT and M. B. M'EWEN (Proc. Roy. Soc., 1939, **A**, **169**, 437—450).—The process $Hg^{2+} + Hg \rightarrow Hg^+ + Hg^+$ is studied for Hg^{2+} ions with energies of 140—400 v. The cross-section of the process is determined; it is shown that a head-on collision is required and that one of the resulting Hg^+ ions is excited by the process. G. D. P.

Atomic electron velocities in nitrogen and methane. A. L. HUGHES and (Miss) M. A. STARR (Physical Rev., 1939, [ii], **55**, 343—350; cf. A., 1938, I, 487).—From an experimental determination of the distribution of energies among the inelastically scattered electrons, the distributions of component velocities among the at. electrons in N_2 and CH_4 are calc. Half of the electrons have component velocities <$1·80 \times 10^7$ in N_2, and <$1·55 \times 10^7$ cm. per sec. in CH_4. Results refer to L electrons only, and in the absence of theoretical data for mol. N_2 and CH_4, are compared with those for at. N and C. N. M. B.

Scattering of fast electrons in gases. A. L. HUGHES (Physical Rev., 1939, [ii], **55**, 350—352).—When fast electrons are scattered elastically by atoms the effect may be regarded as due to the nuclei alone,

the at. electrons playing only a negligible part. The criterion for this, which should give observed scattering corresponding with that predicted by the Rutherford formula, is examined, and it is found that Kuper's results on the scattering of electrons of energy >49,000 v. by He can be accounted for on this basis (cf. A., 1938, I, 425).   N. M. B.

Variations in the relative abundance of the carbon isotopes. A. O. NIER and E. A. GULBRANSEN (J. Amer. Chem. Soc., 1939, **61**, 697—698). —Measurements with a mass spectrometer of high sensitivity and resolving power show a max. variation of 5% in the $^{12}C/^{13}C$ ratio in different compounds. ^{13}C appears to be enriched in limestones, and ^{12}C in plant forms.   E. S. H.

Element 43. E. SEGRÈ (Nature, 1939, **143**, 460—461).—A summary of recent work.   L. S. T.

Some chemical properties of element 43. II. C. PERRIER and E. SEGRÈ (J. Chem. Physics, 1939, **7**, 155—156).—A detailed account of work already noted (cf. A., 1939, I, 3) for the separation of the element.   W. R. A.

Isotopic constitution of nickel and chromium. (MISS) W. A. LUB (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 253—256).—Mass-spectrograph examination of $Ni(CO)_4$ confirms the existence of ^{61}Ni, the abundance of the isotopes being : ^{58}Ni, 68·0; ^{60}Ni, 27·2; ^{61}Ni, 0·1; ^{62}Ni, 3·8; ^{64}Ni, 0·9%. The existence of 0·5% of ^{56}Cr seems probable from examination of $Cr(CO)_6$; the sample used contained only 0·2% of the isobaric ^{56}Fe.   F. H.

Isotopic constitution and the at. wt. of molybdenum. J. MATTAUCH and H. LICHTBLAU (Z. physikal. Chem., 1939, **B, 42**, 288—295).—From the intensity distribution of individual lines in the mass spectra of Mo, measured photometrically, the relative abundance of the isotopes has been determined and the computed at. wt. of Mo is 95·90±0·01 (cf. 95·94±0·06 determined by precision methods).   W. R. A.

Do the isotopes of an element have identical chemical properties ? T. I. TAYLOR (Science, 1939, **89**, 176—177).—Evidence showing that the isotopes of the lighter elements differ sufficiently in chemical characteristics to afford a separation by chemical means is discussed. Using a 100-ft. column, changes in the Li isotope ratio have been effected by means of the reaction Li˙ + Na zeolite ⇌ Li zeolite + Na˙.   L. S. T.

Phenomena of a second type of radioactivity observed by Reboul. W. EICHENBERGER (Helv. Phys. Acta, 1936, **9**, 467—489; Chem. Zentr., 1937, i, 1090; cf. A., 1933, 442).—Photographic activity induced by "semi-conductor cells" is ascribed to the formation of ozonides, which produce H_2O_2 and affect the photographic plate. Ionisation effects are attributed to residual polarisation. The occurrence of radioactivity is thus unconfirmed.   A. J. E. W.

Confusion of radiation with ozone and ozonides. M. FIERZ (Helv. Phys. Acta, 1936, **9**, 490—491; Chem. Zentr., 1937, i, 1090; cf. preceding abstract).—O_3 and ozonised paper and rubber can blacken a photographic plate; paper exposed to the

action of "semi-conductor cells" becomes ozonised in the silent discharge, and causes photographic effects. These do not occur when the experiments are carried out in an atm. of H_2.   A. J. E. W.

Radioactive phenomena of the second order. G. REBOUL (J. Phys. Radium, 1939, [vii], **10**, 151—158).—Polemical. The "chemical" explanation of the action on the photographic plate given by Eichenberger (see above) is only a possible hypothesis which must be completed by the addition of as many sp. hypotheses as there are cases examined.   W. R. A.

Photographic studies in the domain of feeble radioactivity. A. DORABIALSKA and E. TURSKA (Rocz. Chem., 1938, **18**, 457—464).—Radioactivity of the same order of intensity as for K is observed when a photographic plate is exposed to Sb_2O_3, Nb_2O_5, Ta_2O_5, and Y_2O_3. Somewhat feebler effects are given by Bi, Sb, and $La_2(C_2O_4)_3$, whilst ZnS and PbS are without action.   R. T.

Application of Millikan's method to study of feeble radioactivity. A. DORABIALSKA and E. MASŁOWSKI (Rocz. Chem., 1938, **18**, 465—473).—The rate of sedimentation of aërosol particles (tobacco smoke) was measured, in presence or absence of an electric field, and in presence of KCl, Sb, Sb + Al, and Sb_2S_3. The results confirm soft positive radiation of Sb.   R. T.

Method of determining the degree of distribution of the disintegrations of polonium atoms. M. FERBER (J. Phys. Radium, 1939, [vii], **10**, 134—142).—A detailed account of work already noted (cf. A., 1938, I, 488).   W. R. A.

Interpretation of β-disintegration data. H. A. BETHE, F. HOYLE, and R. PEIERLS (Nature, 1939, **143**, 200—201).—The relative merits of Fermi's theory of β-decay and its Konopinski–Uhlenbeck modification are discussed. The experimental evidence favours the original theory.   L. S. T.

Electronic diffusion of rapid β-rays. D. SKOBELTZYN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 427—430; cf. A., 1938, I, 592).—Mathematical.   W. R. A.

Abnormal mechanism of diffusion and absorption of β-rays. D. SKOBELTZYN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 431—435; cf. preceding abstract).—Theoretical.   W. R. A.

β-Ray spectra of ^{62}Cu, ^{64}Cu, and ^{66}Cu. K. SINMA and F. YAMASAKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **35**, 16—23).—The β-ray spectra of the radioactive Cu isotopes ^{62}Cu, ^{64}Cu, and ^{66}Cu were obtained by measuring tracks produced in a Wilson cloud chamber in a magnetic field. The max. energy limits were found to be ^{62}Cu (e^+) 3·4, ^{64}Cu (e^-) 0·70, ^{64}Cu (e^+) 0·71, ^{66}Cu (e^-) 2·9 Me.v.   A. J. M.

γ-Rays from B + D. J. HALPERN and H. R. CRANE (Physical Rev., 1939, [ii], **55**, 415).—Data confirming the results of Gaerttner (cf. A., 1939, I, 172) are reported.   N. M. B.

Fluctuation phenomena in γ-rays. I. J. GÜRTLER. II. R. FÜRTH (Ann. Physik, 1939, [v], **34**,

561—574, 575—584).—I. The fluctuations in the γ-radiation from Ra-C have been investigated by the automatic (electrochemical) registration of discharges and coincidences in two independent counters inclined to each other at angles varying from 0° to 180°. Results are analysed statistically. The ratio of the no. of coincidences to the no. of single discharges in the counters depends on the angle between them. II. Theoretical. Apart from deviations due to the finite resolving power of the apparatus, the results of Gürtler agree with the Poisson distribution law. It is calc. that a no. of the coincidences equal to 10^{-4} of the single discharges are real. This no. decreases with increasing angle between the counters. These coincidences are ascribed to Compton scattering of γ-rays in the Pb surrounding the Ra-C.   O. D. S.

Scattering of slow neutrons by gaseous ortho- and para-hydrogen : spin-dependence of the neutron–proton force. W. F. LIBBY and E. A. LONG (Physical Rev., 1939, [ii], 55, 339—343).— Investigations on room temp. and liquid air temp. neutrons scattered by o-H$_2$ and p-H$_2$ at 90° K. gave results, corr. for the Doppler effect of the motion of the scattering mols, in approx. agreement with those of Brickwedde (cf. A., 1938, I, 548) for liquid H$_2$.
                                                        N. M. B.

Disintegration of the nucleus by neutron impact. H. YUKAWA and Y. MIYAGAWA (Proc. Phys.-Math. Soc. Japan, 1936, 18, 157—166).— Mathematical. An expression is derived for the cross-section of nuclear disintegration by electron impact.   CH. ABS. (e)

Soft radiation from bromine. L. I. RUSSINOV and A. A. JUSEPHOVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 645—646).—EtBr, bombarded in vac. with neutrons from a Rn–Be source, emits a radiation. The intensity of the soft component, which consists of slow electrons of energy 30,000 ev., decreases with a half-period of 4·2 hr. The ratio of the intensities of the soft and hard components is 1, so that each disintegration produces one soft electron and one hard electron. The data are discussed in relation to the theory of nuclear isomerism advanced by Weizsäcker (cf. A., 1937, I, 59).   W. R. A.

Possible radioactivity of antimony. A. DORA-BIALSKA (Rocz. Chem., 1938, 18, 447—456).—Soft induced radiation is detected, using a modified Geiger–Müller counter, in Cu (half-life period 12·4 hr.), Zn (half-life 32·1 hr.), Al, and Cd, after exposing these metals to Sb. Feeble neutronic radiation of Sb is postulated.   R. T.

Action of neutrons on rare-earth elements. G. HEVESY and H. LEVI (Kong. dansk. Vidensk. Selsk., mat.-fys. Medd., 1936, 14, No. 5, 27 pp.; Chem. Zentr., 1937, i, 1089; cf. A., 1936, 403).— Half-life periods varying from 5 min. to several years have been observed in rare-earth elements, Sc, and Y. Data for absorption of the β-rays in Al, and the energy max. of the β-ray spectrum, are given in some cases. Small equiv. wt. changes have occurred in rare-earths under the action of neutrons in minerals.   A. J. E. W.

Efficiency of production of short-range particles from lithium and of 4·4-cm. α-particles from boron under proton bombardment. R. B. BOWERSOX (Physical Rev., 1939, [ii], 55, 323—328).— The excitation functions for the reactions ^{6}Li + ^{1}H → ^{3}He + ^{4}He, and ^{11}B + ^{1}H → ^{8}Be + ^{4}He were determined up to 400 kv. The cross-section of the ^{6}Li nucleus for the reaction followed an exponential curve throughout, and varied from $1·8 \times 10^{-26}$ at 200 to $7·3 \times 10^{-26}$ at 400 kv. The resonance in the production of 4·4-cm. α-particles from B is at 172 ± 5 kv., and their total yield from a thick target was found by integration from the observed yield at 90°. At 200 kv. 13·5 α-particles per 10^{11} protons were observed, rising monotonically to 128 per 10^{11} at 400 kv.   N. M. B.

Electro-disintegration of beryllium. (A) E. GUTH. (B) G. B. COLLINS, B. WALDMAN, and W. R. POYLE (Physical Rev., 1939, [ii], 55, 411, 412; cf. Allison, A., 1939, I, 172).—(A) The process is ^{9}Be + e_V = ^{8}Be + n^1 + $e_{V'}$, where V and V' are the voltages of the electrons before and after disintegration. It is assumed that in the ^{9}Be nucleus a neutron is bound in a p state ; an electron collision causes the formation of an intermediate ^{9}Be nucleus with a neutron bound in an s state of the continuous spectrum leading to a disintegration and a spherically symmetrical distribution of the ejected neutrons. The calc. cross-section is $\sim 10^{-31}$ sq. cm. (B) Be was disintegrated by bombardment with 1·72-Me.v. electrons from an electrostatic generator, and, assuming the products to be ^{8}Be and a neutron, the effect was detected by means of the activity produced in Ag or Rh by these neutrons. The cross-section for the electro-disintegration was $\sim 2 \times 10^{-31}$ sq. cm., and the threshold $\sim 1·65$ Me.v.
                                                        N. M. B.

Transmutations of light nuclei and their theoretical interpretation. T. KAHAN (Compt. rend., 1939, 208, 649—651).—The limitations of the two-body method of treating nuclear collision processes and the general problem of the mechanics of such processes are discussed in relation to nuclear structure. A method of resolving a collision process into successive stages, applicable to light nuclei, is outlined.   A. J. E. W.

Production of artificial radioactive phosphorus $^{32}_{15}$P in unweighable amount from carbon disulphide. O. ERBACHER (Z. physikal. Chem., 1939, B, 42, 173—178).—Irradiation of CS$_2$ by rapid neutrons gives, as well as an unweighable quantity of radio-P, a weighable amount of inactive P which is originally present as white, CS$_2$-sol. P and is subsequently converted by the γ-radiation of the neutron source into red, CS$_2$-insol. P. The radio-P, formed simultaneously, is adsorbed on the surface of the P deposit and can be removed by heating with H$_2$O. After sufficiently long exposures the dissolved P can be completely removed from the CS$_2$ and if this is agitated with H$_2$O and bombarded with rapid neutrons radio-P, $^{32}_{15}$P, is obtained in unweighable amount.
                                                        W. R. A.

Radioactive isotopes of zinc. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1939, [ii], 55,

457—463).—The following reactions are established and discussed : ^{69}Zn from Zn + D, Zn + *n*, Ga + D, and Ga + *n*; half-lives 57±2 min. (−) and 13·8± 0·4 hr. (−). ^{65}Zn from Zn + D, Cu + D, and Cu + H; half-life 250±5 days (+ and K electron capture). There is no evidence of ^{71}Zn. All previously reported Zn activities are reviewed.

N. M. B.

β-Ray spectra of radioactive antimony and sodium. T. AMAKI and A. SUGIMOTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1650—1657).—^{120}Sb obtained by irradiating Sb powder with fast neutrons has a decay period of 16 min. and emits positrons; the upper energy limit is 1·53 Me.v. ^{122}Sb obtained by means of slow neutrons has a decay period of 2·5 days and emits electrons; the upper limit of energy is 1·64 Me.v. ^{24}Na (decay period 15 hr.) was formed by irradiating Na$_2$O deposited on thin Al foil with deuterons of energy 2·6 Me.v. The β-ray spectrum can be resolved into two components having max. energy of 1·76 and 0·81 Me.v. with relative intensities of 4·9 : 1. F. J. L.

Radioactive antimony from I + *n* and Sn + *D*. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1939, [ii], **55**, 414—415).—Bombardment of NaI with the fast neutrons from 8-Me.v. deuterons on Li gave an Sb isotope of half-life 60 days. The reaction must be ^{127}I (*n*, α) ^{124}Sb, and the other known Sb (2·5-day) isotope (cf. A., 1937, I, 490) is therefore ^{122}Sb. The complex activities found in the Sb pptd. from samples of Sn bombardment with 5-Me.v. deuterons show periods of ~2 years, ~45 days, 2·5 days, 3 hr., and 17 min. Present identifications attribute the 17-min. period to ^{119}Sn (*d*, *n*) ^{120}Sn (cf. *ibid.*), and the 2·5-day period to ^{122}Sn (*d*, 2*n*) ^{122}Sb or to ^{120}Sn (*d*, γ) ^{122}Sb. N. M. B.

Nuclear isomerism and chemical separation of isomerides in tellurium. G. T. SEABORG and J. W. KENNEDY (Physical Rev., 1939, [ii], **55**, 410).—It is shown that 8-day I (cf. Livingood, A., 1939, I, 54) is formed from the decay of Te (25 min.) as well as from Te (1·2 days). These Te activities are isomeric, and are formed directly by neutron or deuteron bombardment of Te; their chemical separation is described. N. M. B.

Nuclear excitation of indium by *X*-rays. G. B. COLLINS, B. WALDMAN, E. M. STUBBLEFIELD, and M. GOLDHABER (Physical Rev., 1939, [ii], **55**, 507; cf. A., 1939, I, 173).—The metastable state ^{115*}In was excited when In was irradiated with *X*-rays produced by bombarding a 2-mm. thick Pb target with 1·73-Me.v. electrons from an electrostatic generator. The decay period is ~4 hr., and the threshold of the effect is at 1·35±0·1 Me.v.

N. M. B.

Disintegration of uranium by neutrons : new type of nuclear reaction. L. MEITNER and O. R. FRISCH (Nature, 1939, **143**, 239—240).—Hahn and Strassmann's observation (A., 1939, I, 5, 116) that isotopes of Ba are formed by the bombardment of U with neutrons suggests a new type of nuclear reaction in which a heavy nucleus after taking up a neutron splits into two nuclei of ~ equal size. With U, if one of the new atoms is Ba, the other will be Kr. This

may break up through Rb, Sr, and Y to Zr. Periods that have been ascribed to elements beyond U may be due to light elements. L. S. T.

New type of nuclear reaction. R. D. FOWLER and R. W. DODSON (Nature, 1939, **143**, 233; cf. preceding abstract).—Bombardment of U nitrate with D neutrons produces particles causing an ionisation ≮ 5 times that from natural U α-particles. The no. of counts is doubled by surrounding the ionisation chamber with paraffin. These particles are regarded as Ba ions of ~10^8 v. energy. This supports the conclusion of Hahn *et al.* (A., 1939, I, 116). Bombardment of ThO$_2$ with D neutrons produces a similar effect, which is not increased by paraffin. Th is thus disintegrated into fragments of ~ half the mass of Th having energies of ~10^8 v. L. S. T.

Products of the fission of the uranium nucleus. L. MEITNER and O. R. FRISCH (Nature, 1939, **143**, 471—472).—Recoil nuclei resulting from the fission of U nuclei in the bombardment of U hydroxide by neutrons have been collected in H$_2$O placed near to the bombarded U layer. Chemical tests and decay curves show that the trans-U periods observed previously (A., 1936, 773) must now be ascribed to elements much lighter than U, and that " trans-U " nuclei originate by fission of the U nucleus. L. S. T.

Physical evidence for the division of heavy nuclei under neutron bombardment. O. R. FRISCH (Nature, 1939, **143**, 276).—Bombardment of a U-lined ionisation chamber with neutrons from a Ra–Be source gives ionising particles of at. wt. >70, thus providing physical evidence for the break-up of U nuclei into parts of comparable size (cf. A., 1939, I, 116). Surrounding the source with paraffin doubles the effect. Th gives similar results, but, in this case, paraffin slightly diminishes the effect.

L. S. T.

Disintegration of heavy nuclei. N. BOHR (Nature, 1939, **143**, 330).—Recent observations of the fission of certain heavy nuclei into particles of approx. equal size on bombardment with neutrons are discussed. L. S. T.

Liberation of neutrons in the nuclear explosion of uranium. H. VON HALBAN, jun., F. JOLIOT, and L. KOWARSKI (Nature, 1939, **143**, 470—471).—The lighter nuclei formed by the fission of U due to neutron impact (cf. A., 1939, I, 174, and above) contain more neutrons than the heaviest stable isotopes with the same nuclear charges. Part of this neutron excess is disposed of by emission of a β-ray, which transforms neutrons into protons. Another possible process is the direct liberation of neutrons taking place either as a part of the explosion itself, or as a kind of evaporation from the resulting excited nuclei. Evidence of this second process is afforded by experiments on the density distribution of thermal neutrons produced by the slowing down of photoneutrons from a Ra-γ-Be source in aq. UO$_2$(NO$_3$)$_2$ and aq. NH$_4$NO$_3$, in which at distances from the source >13 cm., the decrease of the neutron density with distance is slower in the UO$_2$(NO$_3$)$_2$ solution.

L. S. T.

Atomic numbers of the so-called transuranic elements. N. FEATHER and E. BRETSCHER (Nature, 1939, **143**, 516; cf. Abelson, below).—A strong prep. of the so-called trans-U elements, which are pptd. with Pt as sulphide in acid solution, has been obtained from 100 g. of U after irradiation with neutrons (^{7}Li + ^{2}H). Absorption measurements with different metal foils of the radiation from the Pt ppt. show that I is one of the elements present in the ppt. The results indicate that the active products hitherto separated with Pt from irradiated U are not trans-U elements but must be regarded as originating in a process of nuclear fission.   L. S. T.

Transmutation of uranium and thorium by neutrons. F. A. HEYN, A. H. W. ATEN, jun., and C. J. BAKKER (Nature, 1939, **143**, 516—517; cf. A., 1939, I, 174).—A saturated solution of $UO_2(NO_3)_2$ was irradiated with slow neutrons from a powerful source and the products were collected in H_2O containing HNO_3 + 1 drop of NH_3. After adding Cs, Rb, Ba, and La salts to this solution the radioactive substances, which were pptd. with Cs, Rb, and Ba, were examined. The results show that bombardment of U with slow neutrons gives Xe and Kr, indicating that the U nucleus may break up in different ways. The following processes also appear to take place : ^{139}Xe $\xrightarrow{\sim 0.5 \text{ min.}}$ ^{139}Cs $\xrightarrow{10 \text{ min.}}$ ^{139}Ba $\xrightarrow{87 \text{ min.}}$ ^{139}La (stable) or Cs $\xrightarrow{30 \text{ min.}}$ Ba → La and ^{88}Kr → ^{88}Rb $\xrightarrow{17 \text{ min.}}$ ^{88}Sr (stable). Corresponding experiments with conc. aq. $Th(NO_3)_4$ irradiated with fast neutrons from a Li + D source resulted in the production of a radioactive gas. At least three periods occur in the alkali ppt., and the ppts. of $SrSO_4$ and $BaSO_4$ were also radioactive. U was not activated by γ-rays from Li bombarded with protons.   L. S. T.

Disintegration of uranium under the action of neutrons, and partition of this element. J. THIBAUD and A. MOUSSA (Compt. rend., 1939, **208**, 652—654).—The presence of Br in the disintegration products of U bombarded with neutrons has been proved by chemical separation as AgBr; a very short period and periods of 90 min. and 20 hr. are observed. The U nucleus is probably split into Br and La, which undergo the following β-transitions : $^{88}_{35}$Br → Kr → Rb → $^{88}_{38}$Sr; $^{151}_{57}$La → Ce → Pr → Nd → 61 → Sm → $^{151}_{63}$Eu. Projected atoms of energy ~50 Me.v. from the bombarded U have been detected by a proportional counter method.   A. J. E. W.

Rupture of uranium nuclei under the action of neutrons, and the resulting liberation of energy. J. THIBAUD and A. MOUSSA (Compt. rend., 1939, **208**, 744—746).—Measurements by proportional ionisation show that the atoms formed by rupture of the U nucleus have a max. energy of 65 Me.v., indicating liberation of a total energy of ~130 Me.v. The atoms have a max. penetration of 5 μ. of Al, indicating that the recoiling nuclei carry positive charges of ~15e, which are reduced by electron capture. The effective cross-section for rupture of U nuclei is $\gtrless 10^{-25}$ sq. cm., corresponding with a resonance process caused by fast neutrons. Absorption of neutrons with energies <100 e.v. does not

affect the rupture phenomena, showing that high-energy neutrons (or possibly γ-rays) are involved. Experiments with Bi, Pb, Tl, Ta, W, and Mo under similar conditions show that the probability of nuclear rupture is <0·004 of that for U. The halogen produced from U is shown by chemical separations to be an isotope of Br.   A. J. E. W.

Droplet fission of uranium and thorium nuclei. R. B. ROBERTS, R. C. MEYER, and L. R. HAFSTAD (Physical Rev., 1939, [ii], **55**, 416—417).—Identification of radioactive Ba in U bombarded by neutrons had been given the interpretation that the nuclear " surface tension " fails to hold together the " droplet " of mass 239, with a resulting division of the nucleus into two roughly equal parts. In confirmation of this, a search for expected recoil particles of energies > 100 Me.v., when U and Th were bombarded with 13·5—0·5-Me.v. neutrons, is reported. Results indicate that U fissions are produced by different processes for fast and slow neutrons, the fast-neutron process requiring >0·5 and <2·5 Me.v. for effective operation. For Th, and in the same range, only the fast-neutron process is effective.   N. M. B.

Heavily ionising particles from uranium. G. K. GREEN and L. W. ALVAREZ (Physical Rev., 1939, [ii], **55**, 417; cf. preceding abstract).—Confirmation of the existence of heavily ionising particles resulting from the splitting of U is briefly reported.   N. M. B.

Intensely ionising particles produced by neutron bombardment of uranium and thorium. R. D. FOWLER and R. W. DODSON (Physical Rev., 1939, [ii], **55**, 417—418; cf. preceding abstract).—Bombardment of U nitrate and ThO_2 with D–D neutrons gave particles producing an intense ionisation. Results are attributed to very high-energy particles of ~ half the mass of the bombarded nucleus, and confirm the results of other investigators on U and Th.   N. M. B.

Cleavage of the uranium nucleus. P. ABELSON (Physical Rev., 1939, [ii], **55**, 418; cf. preceding abstract).—The radiation from the 72-hr. " transuranic " element was shown by crit. absorption measurements to be the K-X-radiation of I. The 72-hr. period was shown chemically to be due to Te, and gives rise to I (2·5 hr.) quantitatively separable. Results are interpreted as a proof of the cleavage of the U nucleus.   N. M. B.

Resonance in uranium and thorium disintegrations and the phenomenon of nuclear fission. N. BOHR (Physical Rev., 1939, [ii], **55**, 418—419).—A detailed discussion of the theory and mechanism of the new type of nuclear reaction recently discovered (cf. preceding abstracts).   N. M. B.

Disintegration of uranium. D. R. CORSON and R. L. THORNTON (Physical Rev., 1939, [ii], **55**, 509).—The disintegration by neutrons of U in the form of UO_3 on thin collodion foils introduced into a cloud-chamber containing air, H_2O vapour, and EtOH vapour at 15 cm. total pressure was observed. Examples of two tracks representing heavy particles recoiling in opposite directions were obtained. There is evidence that the mass of the particle in the main

track must be >75. The max. observed range for the heavy particles was ~3 cm. of air.   N. M. B.

Radioactive recoils from uranium activated by neutrons. E. McMILLAN (Physical Rev., 1939, [ii], 55, 510).—The range of the ejected radioactive particles was measured by observing the distribution of the activity with depth in a series of Al foils placed next to the U (as UO_3) during bombardment. A preliminary attempt to trace any correlation between range and decay periods of the products by following the decay of activity stopped by successive foils of thin paper is described.   N. M. B.

Splitting of uranium and thorium. R. B. ROBERTS, R. C. MEYER, and P. WANG (Physical Rev., 1939, [ii], 55, 510—511).—The ranges of the particles emitted when U and Th are bombarded with neutrons are 10.5 ± 1 and 12.0 ± 2 mm., respectively. There is evidence of delayed emission of neutrons of decay period 12.5 ± 3 sec., possibly due to photo-disintegration by γ-rays. A hard γ-ray of approx. the same period was found. The period of the neutrons and γ-rays is close to one of the β-ray periods observed by Meitner (cf. A., 1937, I, 440).   N. M. B.

Fission of uranium. H. L. ANDERSON, E. T. BOOTH, J. R. DUNNING, E. FERMI, G. N. GLASOE, and F. G. SLACK (Physical Rev., 1939, [ii], 55, 511—512). —Measurements showed that the energies of the fragments of U were $\not> \sim 90$ Me.v. The cross-section of thermal neutrons for the fission process was $\sim 2 \times 10^{-24}$ sq. cm. The efficiency of slow neutrons for the fission process appears to follow a $1/v$ law. There is some indication that the fission does not occur from ^{238}U but from ^{235}U which is present to an amount $< 1\%$. The max. range of the fragments is ~ 1.7 cm., and there is evidence for the presence of several undetermined periods.   N. B. M.

Rupture of radioactive nuclei by neutrons. J. SOLOMON (Compt. rend., 1939, 208, 570—572).— The rupture phenomena are incompatible with a " liquid drop " model for the at. nucleus. The application of Wheeler's model (A., 1938, I, 57), which is preferred, is discussed.   A. J. E. W.

Gaseous radioelement formed in uranium bombarded with neutrons. P. SAVITCH (Compt. rend., 1939, 208, 646—647).—A β-active gaseous radioelement of period ~20 min., formed on bombardment of U with neutrons from a Rn–Be source, has been collected by an electric discharge method, and by condensation on active C.   A. J. E. W.

Observation by the Wilson method of cloud[-chamber] trajectories of the explosion products of uranium nuclei. F. JOLIOT (Compt. rend., 1939, 208, 647—649).—A cloud-chamber track of high ionisation density originating from U bombarded with neutrons (Rn–Be source) is reproduced. Its length, corr. to atm. pressure, is 9 mm., and assuming the track to be due to an atom of mass ~100, a mean charge of $+3e$ and an energy of ~10 Me.v. on emergence from the U oxide layer are indicated. If the projected atom has a max. range of 3 cm. (cf. A., 1939, I, 174) and a mean charge of $+3e$ (which is probably xeceeded by 1—2 units) throughout its path, the initial energy is $\not< 35$ Me.v.   A. J. E. W.

Explosive rupture of the U and Th nuclei under the action of neutrons. F. JOLIOT (J. Phys. Radium, 1939, [vii], 10, 159—160; cf. A., 1939, I, 174).—Data recorded on the formation of radioelements in U irradiated by neutrons are reviewed. Experiments on the rupture of U and Th indicate that the mode of rupture depends on the energy of the incident neutrons; slow neutrons favour the formation of radioactive bodies of long periods. An identical substance (3.5 hr. period) is produced from both Th and U.   W. R. A.

Rupture of nuclei of elements lighter than uranium under neutron bombardment. C. MAGNAN (Compt. rend., 1939, 208, 742—744).—The occurrence of recoil atoms possessing energies of 49—98 Me.v. from U bombarded with neutrons has been confirmed by a proportional ionisation method. No high-energy particles are observed with Bi, Ta, Te, Cd, Ag, Pd, Mo, Zr, or Sr, using a neutron source equiv. to 20 g. of Ra + Be. Recoil atoms of energy 25 Me.v. are observed with W and Ti, with a frequency of one in 2—3 min. Au gives a 40—67-Me.v. particle every 2 min.   A. J. E. W.

Energy considerations of the origin of barium by the neutron bombardment of uranium. S. FLÜGGE and G. VON DROSTE (Z. physikal. Chem., 1939, 42, B, 274—280).—By consideration of the mass defects and the energies liberated when U is decomposed by neutron bombardment into two approx. equal nuclei it is shown theoretically that such decomp. can occur with a heat effect of ~200 Me.v. The heat effect is slightly <, but of the same order of magnitude as, the height of the potential barrier which has to be surmounted.   W. R. A.

Heavy particles produced on the disintegration of uranium and thorium which have been bombarded with neutrons. W. JENTSCHKE and F. PRANKL (Naturwiss., 1939, 27, 134—135).—When U is bombarded with neutrons a radioactive nucleus with the properties of Ba is formed. If the U nucleus has split into two to produce this, the other nucleus must be Kr. This being so, the packing fraction curve indicates that energy of ~160—190 Me.v. must be set free. The ionisation produced by the two nuclei in a cloud chamber filled with N_2 was determined, from which the ratio of the masses of the particles was found to be 139 : 87. An abs. determination of the total ionisation produced by the two nuclei gave for the energies 61 and 98 Me.v., making a total of ~160 Me.v. The ranges of the nuclei were 1.5 and 2 cm., respectively.   A. J. M.

Products of disruption of uranium. O. HAHN and F. STRASSMANN (Naturwiss., 1939, 27, 163—164). —The products of disruption of U on bombardment with neutrons were investigated by passing a current of air through the conc. U solution irradiated with slow neutrons. After drying, the air was passed over a cooled C adsorbent. The C was then treated with an acidified Ba solution, filtered, and the Ba pptd. " as $BaCl_2$." The Ba isotope of half-life 86 min. was detected in the ppt. Under other conditions isotopes of Ba of half-life 14 min. and 300 hr., respectively, were found. For the production of these Ba isotopes,

Xe must have been primarily formed. This Xe has a very short life. Three different isotopes of an alkali metal, probably Cs, are intermediate between Xe and Ba. They have half-life approx. <8 min., 35 min., and >35 min. Sr isotopes have also been obtained.   A. J. M.

Atomic nuclei in cosmic radiation. H. ALFVÉN (Nature, 1939, **143**, 435).—Primary cosmic radiation probably contains electrons and at. nuclei with high energies. The small no. of protons or other nuclei observed at sea-level may be accounted for by assuming that the high-energy nuclei are absorbed by collisions with nuclei in the atm. accompanied by emission of mesotrons.   L. S. T.

East–west asymmetry of cosmic radiation at very high elevations near the equator. T. H. JOHNSON and J. G. BARRY (Physical Rev., 1939, [ii], **55**, 503; cf. A., 1938, I, 549).—Data obtained by balloon flights indicate that ~10% of the high-elevation intensity is produced by unbalanced positives, probably representing that proportion attributable to the hard component. The soft component would then be made up of equal nos. of positive and negative electrons.   N. M. B.

Long-period variations of cosmic rays. P. S. GILL (Physical Rev., 1939, [ii], **55**, 429—433).—A study of yearly variations and of a variation of cosmic-ray intensity with a 28-day period, apparently connected with the sun's rotation, is reported and discussed.   N. M. B.

Motion of the cosmic rays in interstellar space. H. ALFVÉN (Physical Rev., 1939, [ii], **55**, 425—429; cf. A., 1938, I, 429).—The limitation of a current consisting of charged high-energy particles (cosmic rays) passing through interstellar space is discussed.   N. M. B.

Cosmic-ray intensity and geomagnetic effect. T. H. JOHNSON (Rev. Mod. Physics, 1938, **10**, 193—244).—A review dealing with the technique of measurement of cosmic-ray ionisation and the no. of cosmic rays, the determination of the sp. ionisation, and the energy expended per ion pair. The theory of the geomagnetic effect, and the determination of this effect, are also dealt with.   A. J. M.

Intensity of neutrons in cosmic radiation. H. VON HALBAN, jun., L. KOWARSKI, and M. MAGAT (Compt. rend., 1939, **208**, 572—574).—Cosmic neutrons have been detected by formation of $^{80}_{35}Br$ (period 4·5 hr.) in EtBr. In Paris two thermal neutrons are produced per min. per sq. cm. in a layer containing H equiv. to 6 cm. of H_2O; the absorption coeff. in H_2O is small, indicating energies >10^6 e.v. The total thermal neutron yield is >10/sq. cm./min. At 9500 m. altitude this total yield increases to >1000. The no. of neutrons is > that of electrons in cosmic radiation. The resultant activities are attributed to neutrons, or else to an unknown kind of nuclear reaction.   A. J. E. W.

Latitude effect for very large cosmic-ray bursts. W. P. JESSE and P. S. GILL (Physical Rev., 1939, [ii], **55**, 414; cf. Compton, A., 1938, I, 9).—Data obtained on sea voyages over extended periods are reported and discussed.   N. M. B.

Back-ray showers. N. DOBROTIN, N. IVANOVA, and B. ISAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 273—275).—The mechanism of the formation of back-ray showers is discussed. The dependence of the no. of back-ray showers on the thickness of Pb and Al above two groups of proportional counters, so arranged as to eliminate coincidences due to heavy particles, was investigated at an altitude of 3000 m. The results do not agree with previous work, and the causes of the discrepancies are discussed. Experiments carried out at altitudes of 4200 and 5300 m. support the assumption that back-ray showers are connected with the soft component of cosmic rays.   A. J. M.

Splitting of nuclei by cosmic rays at altitudes according to observations conducted with the help of photographic plates with a thick layer. A. GDANOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 641—643).—Thick-layer plates exposed at an altitude (mean height ~4500 m.) show a greater no. of splittings than plates exposed at sea-level (cf. A., 1938, I, 170), and a much greater share of the splitting falls to 4- and 5-component forks. " Tailed " forks, and " showers " of 5 and 6 particles, have also been observed.   W. R. A.

Mesotron and the directional distribution of cosmic radiation. P. WEISZ (Naturwiss., 1939, **27**, 132).—Assuming the radioactive disintegration of mesotrons, the directional distribution of the hard component of cosmic rays cannot be expressed by the absorption law alone, and a new formula is derived which takes into account the mean disintegration path, which is determined to be 8 km. This is rather < the val. obtained by Blackett, but > the val. obtained from considerations of the barometer effect (4·7 km.).   A. J. M.

Lifetime of the Yukawa particle. L. W. NORDHEIM (Physical Rev., 1939, [ii], **55**, 506; cf. A., 1938, I, 550).—A review of various available vals. and calculations.   N. M. B.

Emission of ionising radiations from salts of common metals. G. REBOUL and E. THIBAUD (Compt. rend., 1939, **208**, 568—569).—The absorption coeffs. in air of radiations emitted by salts and oxides of Sn, Pb, Ni, Cu, Fe, and Zn are equal in each case to those observed with the free metals (cf. A., 1938, I, 55), indicating that the metals and their compounds emit radiations of equal λ (3—5·5 A.).   A. J. E. W.

Energy-producing reaction in the sun. G. GAMOW (Astrophys. J., 1939, **89**, 130—133).

Expanding universe and the origin of the great nebulæ. (SIR) J. H. JEANS (Nature, 1939, **143**, 158—159).—The views of Gamow and Teller (*ibid.*, 116) are criticised. The universe as it now stands could be formed by the condensation of a gas with a " thermal " velocity of ~20 km. per sec. Such a velocity can be obtained from H atoms at 19,000°, or from free electrons at −260°, or from a mixture at any temp. between −260° and 19,000°.   L. S. T.

Biological effects of densely ionising radiation. K. G. ZIMMER and N. W. T. RESSOVSKY (Physical Rev., 1939, [ii], **55**, 411).—A discussion of the theo-

retical considerations of Kingdon (cf. A., 1938, I, 123).   N. M. B.

Related magnetic moments of light nuclei. D. R. INGLIS (Physical Rev., 1939, [ii], **55**, 329—336).—A summary and discussion are given of various data, related to the magnetic moments of light nuclei, which can be interpreted, and of others which are apparently irregular, on the assumption that neutrons and protons are simple nuclear building units with const. spin magnetic moments and bound together by simple short-range interactions of an exchange type. Explanations of anomalies are examined.   N. M. B.

Electronic charge. T. H. LABY and V. D. HOPPER (Nature, 1939, **143**, 157—158).—A modified method in which a horizontal electric field is used and the motion of the oil drop is recorded photographically so that a displacement can be measured correct to ~3×10^{-5} cm. is described for the determination of e. Preliminary measurements indicate a val. for e slightly < that found by Millikan. Drops of oil formed by detachment from the steel wires of a brush are electrically charged, and for two samples of apiezon oil and one of castor oil the average no. of electrons per drop is $\propto$ the (radius)^3. Drops of castor oil to which >10^3 electrons are attached have been photographed.   L. S. T.

Debye temperature of the liquid droplet model of the atomic nucleus. K. UMEDA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **35**, 8—15).—Theoretical. The Bethe and Born–Courant methods are applied to surface vibrations in connexion with the liquid droplet model of the nucleus.   A. J. M.

Shape and stability of heavy nuclei. E. FEENBERG (Physical Rev., 1939, [ii], **55**, 504—505).—Mathematical.   N. M. B.

Model of trans-uranium. W. WEFELMEIER (Naturwiss., 1939, **27**, 110—111).—Theoretical. A model of the nucleus of trans-U based on energy considerations and stability is put forward.   A. J. M.

Model of trans-uranium. C. F. VON WEIZSÄCKER (Naturwiss., 1939, **27**, 133).—Theoretical. The model of the trans-U nucleus put forward by Wefelmeier (see above) is discussed.   A. J. M.

Fundamental length introduced by the theory of the mesotron (meson). H. J. BHABHA (Nature, 1939, **143**, 276—277).   L. S. T.

Theory of mesons and nuclear forces. C. MØLLER and L. ROSENFELD (Nature, 1939, **143**, 241—242).   L. S. T.

New form of the baryteron equation and some related questions. F. J. BELINFANTE (Nature, 1939, **143**, 201).   L. S. T.

Static solution of Einstein's field equations for spheres of fluid. R. C. TOLMAN (Physical Rev., 1939, [ii], **55**, 364—373).—Mathematical.   N. M. B.

Massive neutron cores. J. R. OPPENHEIMER and G. M. VOLKOFF (Physical Rev., 1939, [ii], **55**, 374—381).—Mathematical. The gravitational equilibrium of masses of neutrons, using the equation of

state for a cold Fermi gas and general relativity, is investigated, and results are considered in relation to the analytic equilibrium solutions found by Tolman (cf. preceding abstract).   N. M. B.

Nuclear formation under the influence of electrical charges. T. GLOSIOS (Ann. Physik, 1939, [v], **34**, 446—448).—A criticism of Tohmfor and Volmer (A., 1938, I, 559).   O. D. S.

Energy production in stars. H. A. BETHE (Physical Rev., 1939, [ii], **55**, 434—456).—It is shown that the most important source of energy in ordinary stars is the reactions of C and N with protons, these reactions forming a cycle in which the original nucleus is reproduced : $^{12}C + H = ^{13}N$, $^{13}N = ^{13}C + e^+$, $^{13}C + H = ^{14}N$, $^{14}N + H = ^{15}O$, $^{15}O = ^{15}N + e^+$, $^{15}N + H = ^{12}C + ^4He$. Stabilities of unknown nuclei and possible nuclear reactions are considered in relation to sun and star temp. It is shown that no elements heavier than ^4He can be built up in ordinary stars. Suggested energy production mechanism is discussed with reference to the mass–luminosity relation, stability–temp. changes, and stellar evolution.   N. M. B.

Absorption of neutrinos. H. R. CRANE (Physical Rev., 1939, [ii], **55**, 501—502).—An attempt to detect neutrinos by a reverse process to the K-electron capture process is described. The transformation attempted was $^{35}Cl + \mu \rightarrow ^{35}S + e^+$; the ^{35}S decays according to the reaction $^{35}S \rightarrow ^{35}Cl + e^- + \mu$. Negative results were obtained. Energy considerations and the application of the problem to astrophysics are discussed.   N. M. B.

" Failure " of quantum theory at short ranges and high energies. (SIR) A. S. EDDINGTON (Nature, 1939, **143**, 432—433).   L. S. T.

Scattering and splitting of photons on the non-linear field theory of Born and Infeld. S. TOMONAGA and M. KOBAYASI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1643—1649).—The total cross-section for the coherent scattering of photons by nuclear fields has been calc.; it $\propto$ (at. no. of scattering nucleus)^3, and increases as the 4th power of the energy of the incident photon. The total cross-section for the splitting of an incident photon into two photons by the field of the nucleus $\propto$ (at. no.)^2, and increases as the 6th power of the energy of the incident photon.   F. J. L.

Expressions for the current in the Bloch approximation of " tight binding " for metallic electrons. J. BARDEEN and J. H. VAN VLECK (Proc. Nat. Acad. Sci., 1939, **25**, 82—86).—Mathematical.   O. D. S.

Determination of extinction coefficients using the hydrogen lamp as light source. H. STÜCKLEN (J. Opt. Soc. Amer., 1939, **29**, 37—39).—The val. of k in $k = \log I_0/I$ is const. between 2400 and 4400 A. using a H_2 lamp as light source. On each plate the H_2 spectrum is photographed (i) without a filter, (ii) through a filter of known extinction coeff. and the solvent to determine k, and (iii) through different lengths and concns. of solution.   F. J. L.

Interference to extinguish reflexion of light from glass. (MISS) K. B. BLODGETT (Physical Rev., 1939, [ii], **55**, 391—404).—Factors affecting the intensity of the light resultant from the interference of rays reflected from the two boundaries of a thin film are investigated, and the conditions for extinction of reflected light are described. The technique of building films of unimol. layers of 50% Cd arachidate and 50% arachidic acid, to satisfy these conditions, is given.   N. M. B.

Penetration of light through dense fog. M. KINOSHITA, K. UCHIYAMA, and T. NAKAJIMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1681—1689).—The transparency of an artificial fog of droplet size 3 μ. increases with decreasing λ. Sea-water fog and fog containing 5% of HCl cannot be distinguished from pure H_2O fog. If the droplet size is >7 μ. the fog is practically neutral spectroscopically.   F. J. L.

Atmospheric ozone. D. BARBIER and D. CHALONGE (J. Phys. Radium, 1939, [vii], **10**, 113—123).—A more precise method of evaluating the temp. of atm. O_3 is described and has been applied to determinations of O_3 made from stellar spectra. The mean temp. of the O_3 is directly related to the thickness of the O_3, large thicknesses corresponding with high temp. and vice versa. The possibility of the existence of " clouds " of O_3 is discussed.
                                   W. R. A.

Spectrum of potassium deuteride. S. IMANISHI (Nature, 1939, **143**, 165—166).—The KD spectrum, obtained in an arc between K (—) and Ni (+) electrodes burning in an atm. of D_2 at 50—30 cm. pressure, shows many lines between 4300 and 5100 A. Preliminary vals. of rotational consts., and an equation expressing null-lines of the fourteen bands observed, are given.   L. S. T.

Spectrum of tin hydride at high pressure. W. W. WATSON and R. SIMON (Physical Rev., 1939, [ii], **55**, 358—360; cf. A., 1939, I, 118).—Data for SnH spectra produced in a d.-c. arc in H_2 at 5 atm. pressure are tabulated. Two bands in the violet, degrading towards the red, with first heads at 4054 and 4447 A. together are a $(0, 0)^2\Delta \rightarrow {}^2\Pi$ transition with a sharp cut-off at $K' = 17$. Consts. for the $^2\Delta$ and $^2\Pi$ states are evaluated, and some data for a band system in the red with principal head at 6095 A. are given.   N. M. B.

Band spectrum of antimony fluoride (SbF). H. G. HOWELL and G. D. ROCHESTER (Proc. Physical Soc., 1939, **51**, 329—334).—The spectrum of SbF, produced in active N and also by high-frequency discharge, consists of three groups of bands in the regions 3600—5000, 2600—2700, and 2200—2430 A. Most of the bands of the first region belong to two systems (cf. A., 1937, I, 216), and the remaining bands in this group are assigned to a third system. The three systems are considered to be due to transitions between triplet electronic levels. Full data for the ultra-violet triplet system, the components of which are in the other two regions, are tabulated. The final state common to both triplet systems is probably $^3\Pi$. Ex-

pressions for band heads and vibrational consts. are given.   N. M. B.

Ultra-violet band systems of silicon mono-selenide and monotelluride. R. F. BARROW (Proc. Physical Soc., 1939, **51**, 267—273).—A detailed account of results previously reported (cf. A., 1938, I, 552). Vibrational analyses and expressions for the band heads are given. The systems are analogous to those of SiO and SiS, and data are briefly discussed in relation to the corresponding systems of PbO, PbS, PbSe, and PbTe, and other similar mols. of group IVb elements.   N. M. B.

TiO bands in the spectra of stars. P. P. DOBRONRAVIN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 330—332).—The spectra of low-temp. stars (2500—4000°) have strong absorption bands corresponding with TiO (M spectral class), ZrO (S class), and C_2 and CN (R and N classes). The λ of the TiO bands in stellar spectra correspond with most vibrational transitions observed under laboratory conditions. A new system of TiO bands has been found and is classed as the $^3\Sigma$—$^3\Pi$ system.   A. J. M.

Combination of nitrogen and oxygen in the glow discharge. W. HOLTZ and R. MÜLLER (Ann. Physik, 1939, [v], **34**, 489—520).—The spectra in the various regions of the glow discharge in NO, NO_2, N_2O, and in still and flowing mixtures of N_2 and O_2 have been photographed. NO bands were observed in the negative glow in mixtures of N_2 and O_2 in presence of excess of N_2. Max. combination takes place at the boundary of the negative glow. A reaction scheme is proposed.   O. D. S.

Continuous emission spectra of the hydrogen halides and their interpretation. A. K. DUTTA and S. C. DEB (Trans. Bose Res. Inst. Calcutta, 1933—1934, **9**, 177—200).—Continuous spectra from discharge tubes containing HCl, HBr, and HI have max. at $\lambda\lambda$ 2580, 2870, and 3400 A., and regions of secondary emission with max. at $\lambda\lambda$ 3140, 3480, and 4280 A. The principal max. represent energies 10% $>$ the thermochemical dissociation energies for the production of normal H and halogen atoms, and are interpreted as transitions between a repulsive state and the normal stable state. The secondary max. for HCl and HBr represent energies equal to the respective dissociation energies of HCl$^+$ and HBr$^+$.
                                   CH. ABS. (e)

Flame spectrum of HCl. A. K. DUTTA and S. C. DEB (Trans. Bose Res. Inst. Calcutta, 1933—1934, **9**, 201—210).—The spectrum consists of two regions of continuous emission at $\lambda\lambda$ 7000—5500 and 5100—3200 A. The energy of the 7000 A. band (41 kg.-cal.) is approx. equal to the difference between the thermochemical energy of formation of HCl and the dissociation energy of Cl_2. The energy of the second band (56 kg.-cal.) is equal to the dissociation energy of Cl_2.   CH. ABS. (e)

Absorption spectra of certain P^{III} derivatives. T. MIŁOBĘDZKI and W. BOROWSKI (Rocz. Chem., 1938, **18**, 725—731).—The mol. extinction curves of H_3PO_3, Na_2HPO_3, PCl_3, $PCl(OEt)_2$, and of the solutions obtained by hydrolysis of PBr_3 with H_2O, and at p_H 3·5 and 5·9, are continuous; absorption rises

in the order given. The curves for $P(OR)_3$ (R = Me, Et, Pr^α, Pr^β), $P(OMe)_2 \cdot OH$, and $P(OEt)_2 \cdot OH$ have max. at $\lambda = 250$—260 mμ., in which region the curves for $P(OBu^\beta)_3$, $P(OR)_2 \cdot OH$ (R = Pr^α, Pr^β, Bu^β), and $PEtO(OEt)_2$ are flattened. It is concluded that absorption by P^{III} is > that of tautomeric P^V derivatives.　　　R. T.

Ultra-violet absorption aspectra of certain organic molecules. S. VENCOU (Compt. rend., 1939, **208**, 801—803).—The ultra-violet absorption of vapours of AcCl, $CH_2Cl \cdot COCl$, $CCl_3 \cdot COCl$, EtCOCl, PrCOCl, AcBr, and $CH_2Br \cdot COBr$ has been investigated. Only AcCl shows predissociation. The spectrum of AcCl is discussed in more detail; it consists of two systems of bands corresponding with two successive states of vibration and separated by 260 and 342 cm.$^{-1}$, closely approximating to two recorded Raman displacements. By examining thermal data for AcCl, MeCl, and CO the probable mechanism of dissociation of AcCl is given as AcCl = Me + Cl + CO − 107·8 kg.-cal.　　　W. R. A.

Ultra-violet absorption of oximes in the solid state. (MME.) T. GUILMART (Compt. rend., 1939, **208**, 574—576; cf. A., 1933, 1278; 1934, 774).— Extinction coeff. curves (2400—3000 A.) are given for the solid oximes of ethyl-, propyl-, trimethyl-, dimethylethyl-, and dimethyloctyl-acetophenone, indanone, tetralone, benzosuberone, and 1 : 1-dimethyl-indanone, -tetralone, and -benzosuberone. The alkylphenone oximes show much greater absorption at higher $\lambda\lambda$ than those of the trialkylacetophenones, owing to the existence of two forms; in one of these forms no coupling occurs between the N·OH group and the aromatic nucleus, owing to differences in the N·OH valency angles. Similar differences of structure in the benzocyclanone series are discussed.　　　A. J. E. W.

Absorption spectra of some quinones. L. BRÜLL and F. GRIFFI (Gazzetta, 1939, **69**, 28—31).— Extinction coeff. curves of C_6H_6 solutions of benzoquinone, its Cl-, Cl_4-, and Br_4-derivatives, and thymoquinone have been measured in the region 4000—7000 A.　　　O. J. W.

Azines [absorption spectra].—See A., 1939, II, 128.

Structure and absorption spectra of diaminoderivatives of acridine dyes.—See A., 1939, II, 126.

Ultra-violet absorption spectrum and chemical reactivity of some substituted 9-vinylphenanthrenes. V. HENRI and E. BERGMANN (Nature, 1939, **143**, 278).—Although possessing a system of two conjugated double linkings, 9 : 9'-diphenanthryl shows a spectrum practically identical with that of phenanthrene (I). 9-cycloPentenylphenanthrene, which combines easily with maleic anhydride, has fewer and markedly more diffuse bands than (I).　　　L. S. T.

Absorption anisotropy of different radiations for the molecules of several photosensitive colouring matters. S. NIKITINE (Compt. rend., 1939, **208**, 805—807; cf. A., 1938, 1, 318, 528, 579).— The photodichroism, Δ, of cyanin (I), pinacyanol (II), and eosin (III), observed after insolation, has been measured as a function of the λ. Glass plates covered with a collodion film tinted with the dyes were employed. In each case Δ grows from the blue to the red; at the edge of the red it approaches the val. predicted by the theory for a linear oscillator, but does not exceed it. The spectral composition of the white light used for insolation has not a first-order effect on the variation of Δ. The effect of thickness of the collodion film has been investigated. For (I), thickness has little effect on Δ; for (II) and (III) Δ is stronger with a thick film, and for (II) a thick film is fluorescent. The relation between the variation of Δ with λ and the oscillators associated with the absorption is considered.　　　W. R. A.

Relative abundance of CN, C_2, CH, NH, and OH in the solar reversing layer. F. E. ROACH (Astrophys. J., 1939, **89**, 99—115).—The partition functions of possible diat. arrangements of H, C, N, and O have been computed. From these and from the observed solar intensities of rotational lines in the bands of CN, C_2, CH, NH, and OH, vals. of log Sf, where S is the mol. abundance and f the abs. intensity factor, have been determined. From CN (3883 A.) and OH (3064 A.) the excitation temp. found for the sun is $5630° \pm 500°$ and $4640° \pm 550°$ K., respectively.　　　L. S. T.

Atmospheric absorption of infra-red solar radiation at the Lowell observatory. I. A. ADEL (Astrophys. J., 1939, **89**, 1—9).—As part of an investigation of the degree of absorption suffered by incoming infra-red radiations as a consequence of the infra-red telluric absorption spectrum, it is shown experimentally that the influence of the rotation spectrum of H_2O vapour extends down to $\lambda < 8\mu$. Provisional absorption coeffs. describing the degree of opacity produced by this spectrum between 8·34 and 13·40 μ. are tabulated, and applied to the determination of the form of the solar energy curve in interplanetary space throughout this interval.　　　L. S. T.

Relative infra-red content of solar radiations at Bombay. N. R. TAWDE, Y. G. NAIK, and V. D. DESAI (J. Univ. Bombay, 1938, **7**, 68—73).　　　W. R. A.

Atmospheric absorption caused by the rotational water band. W. M. ELSASSER (Physical Rev., 1938, [ii], **53**, 768).—A discussion and explanation of results previously reported (cf. A., 1939, I, 59).　　　N. M. B.

New infra-red absorption band of liquid water at 2·52 μ. J. R. COLLINS (Physical Rev., 1939, [ii], **55**, 470—472).—Absorption was investigated in the range 2·00—2·65 μ. in a search for a weak absorption band predicted as a combination band in liquid H_2O but not in the vapour (cf. Ellis, A., 1931, 1211). A band with a peak at 2·52 μ. with a mass absorption coeff. of ~34 was found.　　　N. M. B.

Spectrum of monodeuteromethane in the photographic infra-red. I. Preparation of the gas, and measurements of a simple band at 9021 cm.$^{-1}$ W. H. J. CHILDS and H. A. JAHN (Proc. Roy. Soc., 1939, A, **169**, 428—437).—The method of prep. was MgMeI + D_2O = MeD + MgI·OD, with amyl ether as solvent. The absorption spectrum was investigated in the range 8400 to 13,000

cm.$^{-1}$, and measurements of a simple band at 9021 cm.$^{-1}$ are given. The moment of inertia of the mol. perpendicular to the C—D axis is deduced and corresponds with a C—H distance of 1·093 A. compared with 1·092 A. for CH_4. G. D. P.

Absorption spectra in the red and near infra-red (6000—10,000 A.). P. BARCHEWITZ (Ann. Physique, 1939, [xi], **11**, 261—350).—A large no. of saturated and unsaturated aliphatic hydrocarbons, aromatic hydrocarbons, their halogen derivatives, alcohols, and amines have been investigated by means of a self-registering spectrograph. Particular attention has been paid to harmonics of NH_2, NH, CH, and OH bands occurring in the spectral range explored and the influences of temp., dilution, and dipole moments of attached groups on the position and intensity of the bands are discussed. W. R. A.

Spectroscopic evidence of hydrogen bonds. (a) Chloroform and bromoform in donor solvents. (b) Aniline and some substituted phenols. W. GORDY (J. Chem. Physics, 1939, **7**, 163—166, 167—171).—(a) Transmission curves from 3·74 μ. to 4·28 μ. for $CHCl_3$ in $COMe_2$, COMeEt, Et_2O, Bu^a_2O, $Pr^β_2O$, dioxan, amyl acetate, C_5H_5N, α-picoline (I), and piperidine (II) and for $CHBr_3$, from 3·86 μ. to 4·46 μ. in $COMe_2$, C_5H_5N, (I), and (II) are compared with those calc. from Beer's law. A new band of considerable intensity, appearing at ~4 μ. and not characteristic of either constituent, is attributed to an NH or OH vibrational band resulting from intermol. binding between the CH of the $CHCl_3$ or $CHBr_3$ and N or O of the solvent.

(b) The absorption near 3 μ. of solutions of *o*-, *m*-, and *p*-$NO_2\cdot C_6H_4\cdot OH$ in C_6H_6, of *o*- and *m*-$NO_2\cdot C_6H_4\cdot OH$ in $PhNO_2$, EtOAc, and Bu^a_2O, and of *o*- and *p*-$OH\cdot C_6H_4\cdot CHO$, Me and Ph salicylate in C_6H_6 has been examined and the effect of inter- and intra-mol. H-bonding on the OH fundamental ν has been studied. The vibrational NH band of NH_2Ph is shifted from 2·90 μ. to 2·83 μ. in 1M- and 0·05M-C_6H_6 solutions and suggests that, through the formation of weak H-bonds, NH_2Ph mols. are associated in the liquid state. NH_2Ph appears to form H-bonded complexes with Bu^a_2O and $Pr^β_2O$ but not with $PhNO_2$. W. R. A.

Spectroscopy of hydroxyl. V. N. KONDRATEEV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 371—372).—The calc. vals. of the intensities of OH bands agree satisfactorily with experiment. The average life of excited OH can be calc. and hence the order of the probability val. of the quenching of the fluorescence of OH. A. J. M.

New OH band in a carboxylic acid [methoxy-benzoic acid]. J. J. FOX and A. E. MARTIN (Nature, 1939, **143**, 199—200).—Absorption curves of *o*- and *p*-$OMe\cdot C_6H_4\cdot CO_2H$ in CCl_4 at 20° are reproduced. The *p*-acid gives the usual carboxylic acid curve, with an OH band at 2·824 μ. and an association band at 3·4 μ. Sharp peaks superimposed on the latter are due to CH vibrations of the C_6H_6 ring and of the Me group. In addition to an OH band at 2·833 μ. and the usual association band, the *o*-acid has a new, intense band at 2·974 μ., indicating the existence in solution of two monomeric forms of this acid. For a given concn., the

association band in the *o*- is < that in the *p*-acid, supporting the view that the new band has formed at the expense of the association band. The lower m.p. and the greater solubility of the *o*-acid in CCl_4 also agree with this view. The absorption spectra of the *m*- and *p*-acids are almost indistinguishable.
L. S. T.

(OH_V) Bands of acids in the vapour state. A new harmonic. P. BARCHEWITZ (Compt. rend., 1939, **208**, 807—809).—Vapours of HCO_2H, AcOH, $CH_2Cl\cdot CO_2H$, $CHCl_2\cdot CO_2H$, $CCl_3\cdot CO_2H$, $EtCO_2H$, $PrCO_2H$, BzOH, $Bu^β CO_2H$, *n*-$C_5H_{11}\cdot CO_2H$, and *o*-$C_6H_4Cl\cdot CO_2H$ have been investigated between 6000 and 10,000 A. and the third harmonic of the (OH_V) band at 2·79 μ. (non-associated state) has been identified at 7549 A. (13,247 cm.$^{-1}$). The location of the (OH_V) band and its harmonics in alcohols and acids is compared. W. R. A.

Absorption of acraldehyde in the infra-red spectrum. P. LAMBERT and J. LECOMTE (Compt. rend., 1939, **208**, 740—742).—The vapour gives absorption max. at 727, 919, 957, 1124, and 1369 cm.$^{-1}$; the spectrum of the polymerised gel is similar, a broad band with ill-defined max. replacing the 919, 957, and 1124 cm.$^{-1}$ bands. Comparison is made with Raman ѵѵ (A., 1926, 10), and the classification of the bands is discussed. A. J. E. W.

Absorption spectra in the far infra-red (20—60 μ.) of halogen derivatives of methane and some monosubstituted derivatives of benzene. P. BARCHEWITZ and M. PARODI (J. Phys. Radium, 1939, [vii], **10**, 143—150; cf. A., 1939, I, 60).—Data on the far infra-red (20—60 μ.) absorption spectra of CX_4 (X = Cl, Br), CH_2Y_2, and CHY_3 (Y = Cl, Br, I) confirm theoretical predictions. The resolution of the bands agrees with the data obtained from the scattering spectra. Some of the bands are identified with various modes of vibration of the mols. The modes of vibration active in the region 20—60 μ. of PhX (X = H, Me, NH_2, CN, OMe, NO_2, Cl, Br, I) are discussed. W. R. A.

Far infra-red investigation of combination vibrations and of the existence of metallic hydrate complexes in crystals. K. H. HELLWEGE (Ann. Physik, 1939, [v], **34**, 521—540).—Measurements have been made of the reflecting power in the region 20—56 μ. of crystals of $BaSO_4$, $SrSO_4$, $CaSO_4$, $CaSO_4,2H_2O$, $MgSO_4,7H_2O$, $CuSO_4,5H_2O$, $KAl(SO_4)_2,12H_2O$ (I), and $KCr(SO_4)_2,12H_2O$ (II). Systems of weak bands at frequencies between the "reststrahlen" and the inner SO_4 vibrations are ascribed to combination frequencies. Sharp "reststrahlen" bands are observed for (I) and (II) at 37·6 and 41·3 μ. respectively. By replacement of H_2O in (I) by D_2O these are shifted to long λλ by an amount indicating that the H_2O mols. vibrate with the metal ion. It is concluded that such metal hydrate complexes also exist in the simple sulphates. O. D. S.

Ultra-violet absorption by cytochrome-*C* and by sodium hyposulphite.—See A., 1939, III, 420.

Intermolecular forces and Raman effect. G. S. LANDSBERG (Bull. Acad. Sci. U.R.S.S., 1938,

Sér. Phys., 373—382).—Investigation of the Raman effect of H_2O and MeOH over a wide range of temp. and pressure shows that the diffuse band given by these liquids at room temp. is displaced somewhat towards higher frequencies as d decreases. When d is sufficiently small the fine line due to the vapour at low pressure coexists with the wide band. This is ascribed to the H link which causes an interaction between the OH groups of neighbouring mols.

A. J. M.

Raman spectra of liquid solutions. A. E. BRODSKI, A. M. SACK, and L. V. KORTSCHAGIN (Proc. Indian Acad. Sci., 1939, **9**, A, 105—108).—A review of the Raman spectra of PCl_3, $AsCl_3$, and $SbCl_3$ in different solvents. W. R. A.

Factors affecting Raman frequencies of carbon-mercury bond. F. S. MARTIN (Iowa State Coll. J. Sci., 1938, **13**, 78—80).—Data are recorded for $HgEt_2$, $HgPr^a_2$, $Hg(CH_2Ph)_2$, $HgPh_2$, $Hg(CN)_2$, and $HgCl_2$ solutions in $COMe_2$ or CCl_4. The aliphatic, but not the aromatic, radicals vibrate as units.

L. J. J.

Raman spectrum of o-deuteroxybenzaldehyde. G. B. BONINO and R. MANZONI-ANSIDEI (R.C. Atti Accad. Lincei, 1938, [vi], **28**, 259—264).—o-$OD \cdot C_6H_4 \cdot CHO$ (I) has been prepared by the action of 99% D_2O on (·$O \cdot C_6H_4 \cdot CHO)_2$ obtained by inter-action of $AlCl_3$ with o-$OH \cdot C_6H_4 \cdot CHO$ (II). (I) has $d_4^{20 \cdot 2}$ 1·1707, $d_4^{22 \cdot 2}$ 1·1689, d_4^{25} 1·1661. The Raman spectra of (I) and (II) have been measured and compared. Some of the lines of (II) are split in the spectrum of (I). The results do not support the view that the properties of aldehydes of this type, which are usually attributed to chelation, can be explained solely by the existence of a H bridge, in which the O atoms of the OH and CO groups are joined to H by homopolar links. O. J. W.

Raman spectra of the hexanes and heptanes. E. J. ROSENBAUM, A. V. GROSSE, and H. F. JACOBSON (J. Amer. Chem. Soc., 1939, **61**, 689—692).—Data for the 9 heptane and 5 hexane isomerides are recorded. E. S. H.

Ultra-violet fluorescence in crystals of alkali halides with U and F centres. N. N. FEDENEV (Acta Physicochim. U.R.S.S., 1938, **9**, 905—916).—The transference of electrons from F to U levels and the existence of a U' level at ~0·5 v. above the U level have been demonstrated. The data are discussed in the light of Tartakovski's theories.

C. R. H.

Crystallochemical investigations on magnesium oxide and lithium fluoride phosphors. E. TIEDE (Ber., 1939, **72**, [B], 611—615).—Mn is a phosphorescence activator for MgO, the max. effect being given by 0·1%. LiF is activated by Mn (optimum 0·02%) and by Cr. Details of prep. are given. The similarity of behaviour of MgO and LiF is attributed to the approx. equality of the corresponding at. radii. F. L. U.

Luminescence decay and related phenomena. W. DE GROOT (Physica, 1939, **6**, 275—289).—The increase and decrease of luminescence with time on intermittent illumination of varying λ, intensity,

and frequency have been studied with ZnS phosphors at varying temp. The results are in agreement with a bimol. recombination of electrons in the conduction bands with holes in the ground levels, occurring in the vicinity of impurity atoms. In addition it is necessary to assume metastable electron levels in the conductivity band, the life time of which decreases with rise of temp. L. J. J.

Variation of light output with current density and classification of willemite phosphors. E. G. RAMBERG and G. A. MORTON (Physical Rev., 1939, [ii], **55**, 409).—Comparison of the observed and calc. variation of the phosphorescent light output with the c.d. of an electron beam bombarding a willemite surface supports the view that its luminescence is similar in character to that of ZnS (cf. Seitz, A., 1938, I, 495). N. M. B.

Luminescence of complex molecules. V. L. LEVSCHIN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 337—340).—The origin of the broad emission and absorption bands of complex mols. in solution, and the connexion between the variation of the spectra and quenching processes due to heating the solutions, were investigated in the case of $(UO_2)^{II}$ salts. There is a considerable difference in the spectra as the temp. is decreased to —180°. The spectrum of solid $(UO_2)^{II}$ salts consists of broad diffuse bands at room temp., but at —180° each band splits into several narrow ones. Two small bands of consider-able intensity appear in the middle of each former broad band. The emission spectrum of $(UO_2)^{II}$ salts in various solvents has been investigated, and conclusions are drawn regarding the force of inter-action between the mols. of solute and solvent. The luminescence yield of various $(UO_2)^{II}$ salts and the problem of temp. quenching have been studied, but although there is always an increase in the luminescence as the temp. falls, this is not uniform. A. J. M.

Fluorescence and absorption of praseodymium salt solutions. J. LARIONOV, O. V. NOVIKOVA-MINASCH, and A. SEIDEL (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 325—327).—Measurements on Pr salt solutions reveal a broad absorption band ~2150 cm.$^{-1}$ wide with a max. at about 2150 A. The fluorescence spectrum contains ultra-violet bands of range 2200—2650 A. and 2650—3100 A. and one in the blue-green region. L. G. G.

Absorption and fluorescence spectra of pigments of St. John's wort.—See A., 1939, III, 439.

Chemiluminescence of 3-aminophthalhydr-azide.—See A., 1939, II, 183.

Fluorescence spectra of aniline vapour. A. T. VARTANJAN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 341—368).—At low pressures (0·02 mm.) and room temp. the fluorescence spectrum of NH_2Ph depends on the λ of the exciting radiation. A discontinuous spectrum is obtained with exciting radiation of λ 2937 A. and a continuous one with λ 2800 A. The discontinuous emission is a resonance emission from the 34034 cm.$^{-1}$ level. Where absorption and fluorescence spectra overlap, the bands of both coincide. The fluorescence spectrum becomes more diffuse with rise of temp. and pressure. In

the presence of foreign gases (except O_2) the intensity of many bands increased. O_2 is the strongest quencher of the fluorescence of NH_2Ph vapour.

A. J. M.

Quantum-mechanical discussion of the dipole moments of monochlorobenzene and of vinyl chloride. J. A. A. KETELAAR (Rec. trav. chim., 1939, **58**, 311—315).—Theoretical. Extending his theory (see below), the author has derived a method for calculating dipole moments which gives vals. for PhCl and $CH_2{:}CHCl$ in good agreement with experimental vals. There is no fundamental distinction between compounds of aliphatic and aromatic C, as the apparent differences can be accounted for if proper allowance is made for resonance in the latter case.

C. R. H.

Dipole moments of some nitronaphthylamines. V. G. VASILIEV and J. K. SIRKIN (J. Phys. Chem. Russ., 1938, **12**, 153—154).—The moments of 2 : 1-, 1 : 2-, and 5 : 1-$NO_2{\cdot}C_{10}H_6{\cdot}NH_2$ are 4·89, 4·47, and 5·22 × 10^{-18} respectively.

J. J. B.

Electric moment of cellosolves. W. H. BYERS (J. Chem. Physics, 1939, **7**, 175—177).—Cellosolves, $OH{\cdot}[CH_2]_2{\cdot}OR$ (R = alkyl), resemble both ethers and alcohols, and are therefore excellent org. solvents. The variation of electric moments of Me, Et, and Bu^a cellosolves is similar to that of alcohols and quite unlike that of the symmetrical ethers. This is explained on the basis of increased valency angles by repulsion.

W. R. A.

Refraction and dispersion of air for the visible spectrum. H. BARRELL and J. E. SEARS (Phil. Trans., 1939, **238, A**, 1—64).—Using an interference refractometer, which is described, the refraction and dispersion of dry, CO_2-free air has been investigated between 12° and 31° at pressures between 100 and 800 mm. Hg. A general interpolation equation has been derived from which definitive vals. of n may be obtained in good agreement with observed vals. The effect of humidity on refraction has been examined. No evidence has been found in favour of the suggested relation between refractivity of air and sunspot activity.

W. R. A.

Refraction data on liquid C_3 hydrocarbons. A. V. GROSSE and C. B. LINN (J. Amer. Chem. Soc., 1939, **61**, 751—752).—Data for n_D and d_4 of propane, propene, *cyclo*propane, allylene, and allene at −20° to −80° are recorded.

E. S. H.

Metal models and chemical linkage. M. M. BIEDERMANN (Chem. Weekblad, 1939, **36**, 146—151). —The free electron theory of the structure of metals is reviewed.

D. R. D.

Structure of artificial magnetite. K. STARKE (Z. physikal. Chem., 1939, **42, B**, 159—172).—The difference in composition and chemical behaviour between artificial magnetite, prepared according to methods which are described, and natural magnetite is attributed to the imperfect filling of cation lattice spaces and partial replacement of O'' in the anion lattice by OH'. The direct oxidation of Fe_3O_4 to γ-Fe_2O_3 is probably accompanied by an indirect oxidation proceeding by way of a ferroferrite

$2FeO,3Fe_2O_3$. The possibility of the appearance of two modifications of Fe_3O_4 is discussed.

W. R. A.

Constitution of iodic acid. M. R. NAYAR (Current Sci., 1939, **8**, 73—74).—From measurements of d, η, surface tension, parachor, n, sp. refraction, and conductivity it is shown that at concns. >0·10N. the mol. is trimeric, $(HIO_3)_3$, between 0·10N. and 0·04N. it is dimeric, $(HIO_3)_2$, and at <0·04N. it is monomeric, HIO_3.

W. R. A.

Generalisation of fundamental equations of aërodynamics and electrodynamics. (A) A. K. TIMIRJAZEV. (B) D. I. BLOCHINZEV, M. A. LEONTOVITSCH, I. E. TAMM, and J. I. FRENKEL (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 577—590, 591—598). —Criticisms of the work of Kasterin (cf. A., 1937, I, 399).

Effect of hindered rotation of the CH_3 group in simple hydrocarbons on the mutual binding of the atoms. A. EUCKEN and K. SCHÄFER (Naturwiss., 1939, **27**, 122—124).—For a mol. such as C_2H_6, investigation of the mol. heat, particularly at low temp., agrees with the fact that the mol. is a strongly hindered rotator (~3000 g.-cal.), the intramol. frequency being 1140 cm.$^{-1}$ Spectroscopic observations put C_2H_6 in the symmetry class D_{3h}, in which the H atoms of the CH_3 groups are directly opposite each other. It follows that there must be a comparatively large force of attraction between the H atoms. The limited rotation of the mol. can be based on the assumption that the electron distribution about the C–C binding is not perfectly symmetrical, but that there is a slight heaping up of electrons in the plane of the H atoms. The arrangement of the electrons and the configuration of the electron clouds in the two positions of the C_2H_6 mol. are considered. Electrostatic considerations alone give a val. of 2370 g.-cal. for the hindrance, in satisfactory agreement with experiment. A more exact quantum-mechanical treatment is also given. For C_3H_8 the val. of the hindrance to rotation is ~3600 g.-cal., and the same considerations hold as for C_2H_6. For $CHMe{:}CH_2$, however, somewhat different conditions hold, and the hindrance is ≪ for C_2H_6.

A. J. M.

Quantum-mechanical discussion of the carbon-chlorine bond in the chlorine substitution derivatives of ethylene and benzene. J. A. A. KETELAAR (Rec. trav. chim., 1939, **58**, 266—276).— Theoretical. Calculations have been made by means of the valency bond method of the double bond character of the C–Cl bond due to resonance. The calculations have been compared with data on reactivity, bond energy, and interat. distances.

C. R. H.

Potential function of the acetylene molecule. I. T. Y. WU and A. T. KIANG (J. Chem. Physics, 1939, **7**, 178—186).—Mathematical. Anharmonicity coeffs. in the vibrational energy expression of C_2H_2 have been calc. in terms of the consts. in the most general first- and second-order perturbing potentials consistent with the geometrical symmetry of the mol. The relation between bond consts. and mol. structure is discussed.

W. R. A.

Electronic structure of some polyenes and aromatic molecules. VII. Bonds of fractional order by the molecular orbital method. C. A. COULSON (Proc. Roy. Soc., 1939, **A**, *169*, 413—428). —A new definition of the order of a bond in an aromatic compound is proposed, depending on the coeffs. of the wave functions in the occupied orbitals. The method is applied to a discussion of orders and lengths of bonds in the conjugated chain mols. $C_{2n}H_{2n+2}$.

G. D. P.

General theory of X-ray interference. M. MARUE (Sci. Rep. Tôhoku, 1939, *27*, 410—427).

F. J. L.

Application of Röntgen-ray Fourier analysis to questions of chemical linkage. R. BRILL, H. G. GRIMM, C. HERMANN, and C. PETERS (Ann. Physik, 1939, [v], *34*, 393—445; cf. A., 1939, I, 124).— Discussion and practical application.   O. D. S.

Effect of quartz filters on the distribution of energy in Laue patterns. G. W. FOX and D. W. STEBBINS (Physical Rev., 1939, [ii], *55*, 405—408).— Laue photographs were taken of *AT*- and *Y*-cut quartz crystals with radiation filtered by another crystal of the same cut and orientation, when the crystals could be oscillated in different harmonics at different temp. Oscillation of the crystal farthest from the X-ray tube gave an increase of intensity of its pattern comparable with that observed with unfiltered incident radiation; oscillation of both crystals gave a greater increase. Oscillation of the first crystal produced no effect. Results are explained by a reduction of primary extinction and an increased range of λ reflected from the interior during oscillation. No appreciable temp. effect was observed.   N. M. B.

Radiograph of a crystal having close-packed hexagonal lattice. M. MASIMA, M. KURODA, S. SAKUI, and H. WATANABE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, *34*, 1705—1739).—127 Laue photographs of a close-packed hexagonal Mg crystal are recorded. By the aid of these photographs it is possible to find the orientation of any close-packed hexagonal crystal.   F. J. L.

Number of physically simple crystal forms. G. B. BOKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, *21*, 240—241).—The no. of physically different simple crystal forms is estimated at 146. There are 47 physically enantiomorphic simple forms.

A. J. M.

Crystal nuclei. G. KORNFELD (Ann. Physik, 1939, [v], *34*, 488; cf. Monatsh., 1916, *37*, 375).— A criticism of Hammer (A., 1938, I, 609).

O. D. S.

Lattice constant of sodium. E. ARUJA and H. PERLITZ (Z. Krist., 1938, *100*, 195—200).—Debye–Scherrer X-radiograms give *a* 4·2820±0·0005 A. at 20°; $\rho_{calc.}$ 0·9660. Intensities are discussed.

I. McA.

Thermal vibrations and atomic structure of zinc crystals at 100° and 298° K. G. E. M. JAUNCEY and E. M. McNATT (Physical Rev., 1939, [ii], *55*, 498—501; cf. A., 1937, I, 447).—An investigation of the diffuse scattering of X-rays from single crystals of Zn over a wide range of scattering angles shows that the root-mean-square displacements of the crystal

atoms at 100° K are 0·098 and 0·050 A. for orientation angles of 0° and 90°, respectively. At the m.p. of Zn the val. in a given direction is probably ≯8% of the axial distance in the same direction. The at. scattering factors at 90° scattering angle are > would be expected on quantum theory. At large scattering angles the scattered ray intensity curves approach each other irrespective of temp. or orientation, the intensity approaching that of X-rays scattered from a gas of Zn atoms.   N. M. B.

Widths of X-ray reflexions at 86° and 293° K. G. W. BRINDLEY (Proc. Leeds Phil. Soc., 1939, *3*, 520—525).—Widths of X-ray reflexions from Mg, Al, and Cd at 293° and 86° K. show only slight differences attributable to contraction of the lattice at the lower temp. With Sn, the reflected beam is broadened at the lower temp.; this is ascribed to distortion arising from the metastable condition of white Sn at low temp.   H. C. G.

Single-crystal palladium films and their interaction with gases. S. FORDHAM and R. G. KHALSA (J.C.S., 1939, 406—412).—Electron diffraction patterns yield 3·894±0·005 A. for the lattice const. of Pd leaf relative to *a* = 2·456 A. for graphite, in good agreement with the val. obtained from X-ray measurements. At >200° Pd alloys with Ni or Pt and accordingly Pd films were supported on mica, rock-salt, or Pd gauze. Pd did not amalgamate with Hg under different described conditions. The orientations of Pd by evaporation on to rock-salt cleavage surfaces at >350° is discussed. Heat-treatment in a vac. up to 800° does not change the diffraction patterns. Oxidation at 600° gives PdO and orientations are discussed. The effects of heat-treatment of Pd or Pt in H_2 or NH_3 have been investigated.   W. R. A.

X-Ray diffraction by supercooled liquid sulphur. S. R. DAS and K. D. GUPTA (Nature, 1939, *143*, 332).—S can be kept for several days in the supercooled liquid state at 25—30° as small globules on clean glass surfaces. On metal surfaces it is less stable and solidifies readily. Under given conditions, the stability inversely ∝ drop-size. Drops in the supercooled state retain the colour possessed at higher temp. before cooling. X-Ray diffraction photographs of supercooled drops show a single band corresponding with a Bragg spacing of 3·68±0·02 × 10^{-8} cm., which agrees with those observed for liquid S at temp. > the m.p.   L. S. T.

Conversion of vitreous and monoclinic (α) selenium into the hexagonal modification. S. R. DAS and K. D. GUPTA (Nature, 1939, *143*, 165).— Powdered vitreous Se, even in the absence of tension, is completely transformed into the hexagonal form by sufficiently prolonged heating (approx. 2 weeks) at 43° (cf. A., 1938, I, 15). Monoclinic Se is transformed at 100° after 24 hr., but at 80° requires several days.   L. S. T.

Crystal structure of thorium phosphides. K. MEISEL (Z. anorg. Chem., 1939, *240*, 300—312; cf. A., 1938, I, 410).—Th_3P_4 is body-centred cubic, space-group T_d^6, *a* 8·600 A., with 4 mols. in the unit cell. At. positions and structure-diagrams are given.

The Th—P and P—P distances are respectively 2·98 and 3·20 A. Th sub-phosphide is face-centred cubic with a 5·818 A. The X-ray results indicate a NaCl structure, implying the formula ThP, but a diagram free from the lines of the higher phosphide is obtained only with preps. having $\leqslant$ 50 at.-% P. Probably the binding forces are so weak that ThP cannot exist without losing some P, leaving vacant spaces irregularly distributed in the lattice.   F. J. G.

Structural changes in anhydrous barium chloride by further heating. (MISS) C. LEIBER (Z. physikal. Chem., 1939, **42**, B, 240—248).— Anhyd. $BaCl_2$, after different pretreatments, was heated and structural changes were followed by the " emanation " method. The curve obtained by plotting the amount of emission against temp. shows discontinuities at 300°, ~540°, and 900°. The discontinuity at 300° is attributed to a structural change in the crystal lattice. Further heating to 540° brings about a reversal to the original lattice. A sharp peak at 925° corresponds with the transformation $\alpha \rightarrow \beta\text{-}BaCl_2$.   W. R. A.

Twin lamellæ of boric acid. H. TAZAKI (J. Sci. Hiroshima Univ., 1939, A, **9**, 21—28).—Twinned crystals of boric acid recryst. from H_2O have been found by X-ray examination to consist of three different types. The twinning axes and planes with the same orientation in the two components of the twin are : (1) [230] (axis), ($\bar{3}$21), and ($3\bar{2}$1) (planes), (2) [010], (100), ($\bar{2}$01), and ($\bar{3}$02) ; (3) [$\bar{4}$10], (141). Measurements by a method employing convergent X-rays indicate that the thin sheets of crystal layers have a tendency to arrange themselves in fibres, with the twinning axis as fibrous axis parallel to the c-face.   J. A. K.

Crystalline structure of azides. Constitution of the azide anion. M. BASSIÈRE (Compt. rend., 1939, **208**, 659—661 ; cf. A., 1926, 113).—The unit cell of NaN_3 is rhombohedral, and has a 5·488$\pm$0·011 A., α 38° 43'. Structure factor data are calc. from corr. intensities, and an electron density curve for the N_3' ion is given. Agreement with the curve calc. by Fourier analysis is not obtained unless a dissymmetric structure with N—N distances of 1·10 and 1·26 A. is assumed. The calc. Debye temp. of the crystal is 505° K., the observed val. being 460° K.   A. J. E. W.

Structure of the SnCl$_4''$ group. H. BRASSEUR and A. DE RASSENFOSSE (Nature, 1939, **143**, 332—333).—X-Ray investigation of K_2SnCl_4,H_2O (I) indicates that the $SnCl_4''$ group is not co-planar (cf. A., 1937, I, 118). The structure is almost identical with that of K_2HgCl_4,H_2O, the $SnCl_4''$ groups being obtained from octahedral $SnCl_6$ groups sharing edges parallel with the (010) plane and forming columns of so-called " rutile " octahedra in the direction of the b axis. (I) probably contains 1 and not 2 H_2O.   L. S. T.

Crystal structure of Rb_2SnI_6 and Cs_2SnI_6. W. WERKER (Rec. trav. chim., 1939, **58**, 257—258).— X-Ray analysis shows that both compounds belong to the K_2PtCl_6 type.   C. R. H.

Comparison between Bi_2Te_3 and Bi_2Te_2S. P. W. LANGE (Naturwiss., 1939, **27**, 133—134).— The cryst. structure of Bi_2Te_3 and Bi_2Te_2S is compared. Both have a typical layer lattice. X-Ray investigation of mixtures with compositions between Bi_2Te_3 and Bi_2Te_2S show that these two compounds co-exist over this range. The powder diagram shows only the lines corresponding with the two compounds. Hence the transition between Bi_2Te_3 and Bi_2Te_2S is discontinuous, and the two must be regarded as distinct phases.   A. J. M.

Crystal structure of NH_4HgCl_3. E. J. HARMSEN (Z. Krist., 1938, **100**, 208—211).—By X-ray analysis the tetragonal cell has a 4·19, c 7·94 A. ; 1 mol. per cell ; $\rho_{calc.}$ 3·84. Complete at. parameters and inter-distances are determined for the structure, which consists of layers of Hg surrounded by Cl at the corners of flattened octahedra (establishing $HgCl_2$ complexes), the layers being held by NH_4 ions 8-co-ordinated to Cl at 3·38 A. Hg—Cl are 2·96, 2·34 A. Cleavage and optical properties are explained.   I. McA.

Cobaltinitrites of bivalent metals. A. FERRARI and L. COGHI (Gazzetta, 1939, **69**, 3—10 ; cf. A., 1936, 41).—X-Ray measurements show that $Pb_3[Co(NO_2)_6]_2$ and $Ba_3[Co(NO_2)_6]_2$ have the same type of lattice as $K_3[Co(NO_2)_6]$, with a 10·42, 10·57 A., $d_{calc.}$ 3·785, 3·040, respectively. When prepared by pptn. from $Na_3[Co(NO_2)_6]$ and the bivalent metal nitrate, the cobaltinitrites of Pb and Ba contain varying amounts of H_2O, which is present in the zeolitic form. The corresponding compounds of Sr and of Cd could not be obtained.   O. J. W.

Structure of $OsO_5C_4Me_8$. H. NOWOTNY and E. HENGLEIN (Naturwiss., 1939, **27**, 167).—$OsO_5C_4Me_8$ (Criegee, A., 1936, 603) crystallises in tetragonal needles, the prism faces coinciding with {110}. a, 10·1$_5$, c, 7·28$_5$ A. ; 2 mols. in unit cell. Laue symmetry D_{4h}.   A. J. M.

Diffraction of X-rays by gas molecules. Comparison with electron diffraction and discussion of results for $SiHCl_3$. M. H. PIRENNE (J. Chem. Physics, 1939, **7**, 144—155).—The applicability of the diffraction of X-rays and electrons by free mols. to the determination of mol. structure is considered. It is concluded that the fullest information can be obtained by X-ray examination in which the no. of parameters to be determined is much reduced, and by an electron investigation which will determine the remaining parameters. This is illustrated by reference to the mol. structure of $SiHCl_3$.   W. R. A.

Stereochemistry of quadricovalent atoms : gold. H. J. DOTHIE, F. J. LLEWELLYN, W. WARD-LAW, and A. J. E. WELCH (J.C.S., 1939, 426—428).— In K 2 : 2'-dipyridylaurocyanide, K[Au(CN)$_2$dipy] (I), and the salts of 4 : 5-(o-phenanthrolineaurocyanide, M^I[Au(CN)$_2$phenan] (II) (M^I = K, Tl, NH_4), Au is quadricovalent and has effective at. no. 86, that of Rn. By analogy with quadricovalent Cu, Ag, and Tl compounds a tetrahedral distribution of valencies around the Au atom would be expected. X-Ray analyses indicate, however, that (I) and (II) are

planar or only slightly distorted from planar. (I) is formed by the action of 2 : 2'-dipyridyl (in EtOH) on aq. $KAu(CN)_2$ as colourless, orthorhombic, birefringent crystals. The unit cell contains 4 mols., a 18·15, b 18·74, c 3·74 A. ($d_{obs.}$ 2·32, $d_{calc.}$ 2·31), space-group $B22_12$—D_2^5, and the mol. has a twofold axis of symmetry. (II) ($M^I = K$) is formed by the action of 4 : 5-(o-)phenanthroline (III) (in EtOH) on aq. $KAu(CN)_2$ as acicular monoclinic crystals, nearly all twins, highly birefringent, strong positive pyroelectric effect, 8 mols. per unit cell, space-group C_c. When a saturated solution of $TlNO_3$ is added to warm aq. (II) ($M = K$) colourless needles of the Tl salt are formed. The NH_4 salt is prepared by adding (III) to $NH_4Au(CN)_2$ (prep. described).

W. R. A.

Crystal structure of NaCN. H. J. VERWEEL and J. M. BIJVOET (Z. Krist., 1938, **100**, 201—207; cf. A., 1935, 1060).—X-Ray intensities for the cubic (NaCl type) form with a 5·87 A. indicate rotation of CN groups, with C—N 1·06 A. On cooling, without destruction of the single-crystal orientation, a reversible transition occurs at ~15° to the rhombic form, the 2-mol. cell of which at −10° has a 3·74, b 4·71, c 5·61 A. At. parameters indicate a parallel arrangement of CN groups with C—N 1·05 A.

I. McA.

Crystal structure of methane at the transition point, 20·4° K. A. MÜLLER and A. SCHALLAMACH (Nature, 1939, **143**, 375—376).—X-Ray investigation confirms the previous result (A., 1931, 790) that the lattice of CH_4 above and below the transition point is a face-centred cube. Near the transition point new, additional lines, which are essentially connected with the transition, have been observed. L. S. T.

Determination of the space group of crystalline p-azotoluene. M. PRASAD and M. R. KAPADIA (J. Univ. Bombay, 1938, **7**, 94—96).—Crystals of p-azotoluene are monoclinic prismatic, with a 12·00, b 4·851, c 9·703 A., $a : b : c = 2·474 : 1 : 2·000$. Interfacial angles have been measured. The space-group is C_{2h}^5, 2 mols. per unit cell, and the mols. have a centre of symmetry. W. R. A.

Electron density and interatomic distances in tetragonal pentaerythritol. I. NITTA and T. WATANABE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1669—1680).—The at. co-ordinates of $C(CH_2·OH)_4$ have been determined by the "trial and error" method, and finally by Fourier syntheses, to be C 0, 0, 0; CH_2 0·160, 0·128, 0·100; OH 0·312, 0·248, 0·002, in good agreement with the vals. of Llewellyn et al. (A., 1937, I, 448). The C–C and C–O bonds are 1·53 and 1·45 A. respectively, and the "H bridge" is 2·70 A. F. J. L.

Constitution and crystalline structure of cellulose.—See A., 1939, II, 203.

Chain structure of linear polyesters. C. S. FULLER and C. J. FROSCH (J. Physical Chem., 1939, **43**, 323—334).—X-Ray fibre patterns of C_2H_4 polyesters of succinic, adipic, suberic, azelaic, and sebacic acids and the self-polyester of ω-hydroxydecoic acid indicate that, with the exception of the first polyester, the polyesters conform to a planar zig-zag type of chain structure. The succinic ester normally possesses a helical configuration, but it can also possess a planar zig-zag chain structure similar to that of the other esters. Polyesters containing an odd no. of chain atoms in the repeating unit conform to the same unit cell as has been found for $C_{20}H_{60}$ except for the c dimension. This does not hold for polyesters containing an even no. of chain atoms, and to explain the difference the authors suggest that in "odd" polyesters the repeating units arrange themselves with the terminating and median C:O groups in planes perpendicular to the fibre axis, whilst in "even" polyesters the corresponding C:O groups of successive chains are displaced along the chain direction with respect to one another so as to fall in planes inclined to the fibre direction.

C. R. H.

Study of surfaces by electron diffraction. G. I. FINCH (Bull. Soc. chim. Belg., 1938, **47**, 823—843).—A lecture. E. S. H.

Influence of absorption on the refraction effect for electron beams. I. Measurement of the inner potential of the polar tetrahedral surfaces of zinc blende. P. A. THIESSEN and K. MOLIÈRE. **II. Addition to the Bethe theory of an expression for absorption.** K. MOLIÈRE (Ann. Physik, 1939, [v], **34**, 449—460, 461—472).—I. Electron diffraction measurements on the two polar tetrahedral surfaces of natural Zn blende crystals show that the positive face has a significantly higher apparent inner potential for low orders of reflexion than has the negative face.

II. Theoretical. The influence of absorption on electron diffraction is discussed. The results of Part I cannot be explained by absorption. The difference in inner potential between the two faces may be due to differences in the fine structure of the crystal surfaces. O. D. S.

Migration of barium on molybdenum. M. BENJAMIN and R. O. JENKINS (Nature, 1939, **143**, 279—280; cf. A., 1939, I, 60).—Photomicrographs obtained with the electron microscope show that between ~1000° and 1050° K. Ba migrates uniformly over Mo. Below 1000° K. no movement occurs, and above 1050° K., Ba evaporates rapidly.

L. S. T.

Galvano-magnetic effect of ferromagnetic single crystals. N. HORI (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 1166—1174).—The dependence of the galvano-magnetic effect in ferromagnetic single crystals on the direction of the spontaneous magnetisation has been investigated theoretically. The electric potential of the Hall effect of ferromagnetic single crystals depends strongly on the direction of spontaneous magnetisation relative to the crystal axes. The results of experiments on the Hall effect with polycryst. ferromagnetic substances are explained. A. J. M.

Galvano-magnetic phenomena in mica. V. PRUJININA-GRANOVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 367—370).—In fields ~10^5 v. per cm. a transverse galvano-magnetic (Hall) effect of 10^{-3}—10^{-4} v. is observed at 350°; with similar field

strengths the longitudinal galvano-magnetic effect varies from 10^{-2} to 10^{-3} v. between 125° and 355°. The greater magnitude of the longitudinal effect suggests that the conductivity in mica is effected by fixed electrons. D. F. R.

Inner initial permeability of iron and nickel for 98—410 M.cycles. J. B. HOAG and N. GOTTLEIB (Physical Rev., 1939, [ii], **55**, 410).—Results obtained by a modification of a method previously employed (cf. A., 1933, 117) are reported for the λ range 120—305 cm. N. M. B.

Ramsay and Steele's vapour density measurements on some organic compounds. T. BATUECAS (Z. physikal. Chem., 1939, **183**, 438—454).—The method of calculating mol. wt. used by Ramsay and Steele is criticised, and a more accurate method is successfully applied to their data. The application of v.d. measurements to mol. wt. determination would appear to have a val. > was thought by Ramsay and Steele. C. R. H.

Theory of electrical resistance of a good conductor. F. SAUTER (Naturwiss., 1939, **27**, 109—110).—Theoretical. A method is given by which it is possible to calculate the resistance of a good conductor throughout the entire temp. range. The investigation starts with the formula for sp. resistance based on the Lorentz–Sommerfeld electron theory. A. J. M.

Thermal evolution of the conductivity of thin nickel sheets. A. COLOMBANI (Compt. rend., 1939, **208**, 795—797).—The variation of the resistance R with temp. 0 has been determined at 10° intervals from room temp. to 400° for thin Ni sheets (thicknesses 80—1200 mμ.) obtained by cathodic pulverisation of Ni in H_2. Up to 320° (sensitive point independent of sheet thickness) R is an exponential function decreasing with 0. From 320° to 360° (temp. at which spontaneous magnetism of ordinary Ni disappears) the variation of R is progressive and irreversible, and depends on the sheet thickness. Between 360° and 400° R does not vary. After annealing, however, all the sheets are stable and reversible between 20° and 400°, R varying regularly with 0 and having the same temp. coeff., 2×10^{-3} ohm per degree. The anomalous behaviour between 320° and 360° is parallel to the anomalies in the physical properties of ordinary Ni between these temp. W. R. A.

Energy states of the valency electrons in some metals. I. 10. Anomalous changes of various properties of zinc with temperature. M. SÂTO (Sci. Rep. Tôhoku, 1939, **27**, 278—325).—The anomalous properties of Zn are summarised and an attempt is made to correlate them with regular temp. intervals. The anomalies are divided into four groups. (I) 247—692° K. Abrupt changes in the sp. heat, electrical resistance (R), lattice consts., hardness, shearing work of a single crystal, and v.p. are observed at 443° and 593° K., R of thin films at 247° K. The m.p. is 692° K. If the temp. interval 0—692° K. is divided in the ratio 2 : 3 : 4 : 5 the vals. correspond with the temp. of the anomalies. (II) 550—905° K. Anomalous vals. of R, ρ, magnetic susceptibility, and v.p. are observed at 550°, 796°, and 905° K., and of R at 473° K. The temp. interval rule is also applicable and it is inferred that the anomalies are due to Zn and not to impurities. The anomaly at 905° appears to correspond with the λ point of He. (III) The work of shearing changes abruptly at 90° K. and R at 36° and 90° K. (IV) Zn becomes a superconductor below 0·79° K. F. J. L.

Conductivity of thin films of thallium on a Pyrex glass surface. J. R. BRISTOW (Proc. Physical Soc., 1939, **51**, 349—354; cf. Appleyard, A., 1937, I, 291).—Thin films of Tl, condensed on cooled Pyrex at $<10^{-7}$ mm. pressure, show, at a thickness >40 A., a resistivity only ∼ three times that of the bulk metal, confirming the view that, after the first few at. layers, the evaporated films do not differ radically in structure from the bulk metal. The Tl films differ from alkali films and from Hg inasmuch as they show no conductivity for thicknesses < ∼ five at. layers, and have a finite range of thickness in which the resistivity is very high. In this range the material may be only semiconducting owing to distortion of the normal lattice by the atoms of the substrate. Occluded gas in films deposited in a poor vac. (10^{-7}—10^{-5} mm.) tends to cause wide erratic variations in resistivity and in the temp. coeffs. N. M. B.

Variation of field penetration with temperature in a superconductor. E. T. S. APPLEYARD, J. R. BRISTOW, and H. LONDON (Nature, 1939, **143**, 433—434).—Measurements of the crit. magnetic fields for thin superconducting films of Hg are recorded graphically. The ratio of the crit. field for a film of given thickness to that of bulk Hg at the same temp. increases rapidly in the neighbourhood of the transition temp. Field penetration is concluded to be not const. but to increase rapidly near the transition temp. The no. of electrons responsible for superconductivity may be small or zero at the transition point and may increase rapidly as temp. falls. At 2·5° K., the val. of the penetration depth is ∼1·2 × 10^{-5} cm. L. S. T.

Magnetic anisotropy of manganite crystal in relation to its structure. K. S. KRISHNAN and S. BANERJEE (Trans. Faraday Soc., 1939, **35**, 385—387).—The magnetic anisotropy of a manganite crystal was measured and found to be of the same order of magnitude as that of Cr^{III} and Mn^{II} salts. The Mn atoms are therefore not tervalent, but presumably half are bivalent and half quadrivalent. F. L. U.

Diamagnetic susceptibilities of mercury in various states of combination. S. S. BHATNAGAR, M. B. NEGVI, and G. L. OHRI (Proc. Indian Acad. Sci., 1939, **9, A,** 86—94).—The diamagnetic susceptibilities χ of various org. and inorg. salts of Hg (in both valency states), and double salts, have been measured by a magnetic interference balance. From the vals. thus obtained the susceptibility consts. for the ions Hg˙ and Hg˙˙ have been determined by subtracting the vals. for the appropriate anions, and these are compared with existing theoretical vals. χ of $HgCl_2$ and $HgBr_2$ in C_5H_5N are < χ of the solid compounds. W. R. A.

Diamagnetism of some inorganic liquid compounds. M. B. NEVGI (J. Univ. Bombay, 1938, **7**, 82—88).—The diamagnetic susceptibilities of SCl_2, S_2Cl_2, $SOCl_2$, SO_2Cl_2, $ClSO_3H$, $SiCl_4$, $SiBr_4$, ICl, and $POCl_3$ have been determined by the modified Gouy method. The following vals. have been deduced and are compared with those calc. from theory : $\chi_{S^{+2}} = -9.0 \times 10^{-6}$, $\chi_{S^{+4}} = -5.5$ and -6.8×10^{-6}, $\chi_{Si^{+4}} = -4.2$ and -3.6×10^{-6}, $\chi_{I^{+1}} = -36.7 \times 10^{-6}$, and $\chi_{P^{+5}} = -3.3 \times 10^{-6}$.   W. R. A.

Susceptibility constants of thallium in different states. M. B. NEVGI (J. Univ. Bombay, 1938, **7**, 19—26).—Pure Tl, obtained electrolytically from pure Tl_2SO_4, is diamagnetic in the solid state ($\chi = -0.228 \times 10^{-6}$) and becomes paramagnetic in the vapour state. These observations agree with the facts that Tl is polyat. in the solid state and monat. in the vapour state ; the free electrons in the outer orbit (vapour) combine so that the electron spins compensate each other (solid). The susceptibility const. for the Tl· ion, obtained from experimental vals. of 12 salts by subtraction of the appropriate recorded vals. of χ anion, ranges from -36.33 to -39.77×10^{-6}.   W. R. A.

Magnetic properties of ferric oxide at low temperatures. G. CHARLESWORTH and F. A. LONG (Proc. Leeds. Phil. Soc., 1939, **3**, 515—519).—χ for α-Fe_2O_3 (paramagnetic) is measured over the temp. range 20—180°. The val. of χ_s at 20°, viz., 37.5×10^{-6}, decreases by about 50% at $-24°$ (temp. decreasing), the phenomenon being nearly reversible. Transition to ferromagnetism on warming from $-40°$ to room temp. in a magnetic field is not confirmed.   L. G. G.

Anomalous magnetic properties of anhydrous ferrous chloride. S. S. SCHALYT (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 657—658).—At temp. < the Curie point (23.5° K.) the magnetisation curve for anhyd. $FeCl_2$ shows (i) marked hysteresis, and (ii) an undulating change of magnetic moment with field strength. Above 23.5° K., however, the susceptibility obeys the Curie–Weiss law.   W. R. A.

Magnetochemical studies. XXXI. Paramagnetism of compounds of sexavalent chromium, molybdenum, tungsten, and uranium. W. TILK and W. KLEMM (Z. anorg. Chem., 1939, **240**, 355—368).—The following vals. for $\chi \times 10^{-6}$, independent of temp., are recorded : CrO_3, 0.40; $K_2Cr_2O_7$, 0.10; $Na_2Cr_2O_7$, 0.21; K_2CrO_4, -0.02; Na_2CrO_4, 0.07; MoO_3, 0.02; K_2MoO_4, -0.16; Na_2MoO_4, -0.10; WO_3, -0.06; K_2WO_4, -0.18; Na_2WO_4, -0.14; $UO_2(NO_3)_2$, 0.06; UO_4, 0.17; UO_3, 0.26; K and Na uranates (formulæ doubtful), 0.18 and 0.21, respectively. From these, after correction for the diamagnetism of other ions present, vals. for the mol. susceptibilities of the sexavalent positive ions are computed as follows : Cr^{6+}, 73; Mo^{6+}, 45; W^{6+}, 30; and U^{6+}, 129 (all $\times 10^{-6}$). These vals. and those for neighbouring elements in the periodic table are compared, and their relationships to the colours and stabilities of the corresponding compounds are discussed.   F. J. G.

Constant paramagnetism of quadrivalent cerium and of other ions possessing the same number of electrons as the rare gases. G. FOËX (Compt. rend., 1939, **208**, 738—740).—Vals. of χ_a for Ti, V, Cr, Mn, Mo, W, Re, and U in inert-gas type electron structures are reviewed. Weak paramagnetism of Ce^{IV} is confirmed by measurements on $Ce(SO_4)_2,4H_2O$ (χ_M -97×10^{-6}), giving $\chi_a = +22 \times 10^{-6}$.   A. J. E. W.

Ferromagnetic anisotropy in nickel–iron crystals. Evidence for superstructure near Ni_3Fe. L. W. McKEEHAN and E. M. GRABBE (Physical Rev., 139, [ii], **55**, 505; cf. Kleis, A., 1937, 1, 120).—Curves based on precision measurements for single-crystal spheroids of various compositions subjected to various heat-treatments and rates of cooling are given and discussed. Results are consistent with short distance order (cf. A., 1937, 1, 503).   N. M. B.

Measurements on iron ammonium alum. H. B. G. CASIMIR, W. J. DE HAAS, and D. DE KLERK (Physica, 1939, **6**, 241—254).—Data are recorded for susceptibility and entropy between 0.5° and 4.2° K. Curie's law is valid only if the Lorentz field is taken into account.   L. J. J.

Spin levels and paramagnetic dispersion in iron ammonium alum. R. DE L. KRONIG and C. J. BOUWKAMP (Physica, 1939, **6**, 290—298).—Theoretical. Spin levels are calc. for a const. magnetic field with an arbitrary orientation to the crystal axes. The results lead to a formula different from that of Casimir and du Pré (A., 1938, 1, 391) for the residual susceptibility in alternating fields.   L. J. J.

Collective electron ferromagnetism. II. Energy and specific heat. E. C. STONER (Proc. Roy. Soc., 1939, A, **169**, 339—371; cf. A., 1938, I, 345).—The theory is extended and expressions are obtained for the electronic energy and for the sp. heat at low temp. and at the Curie point. The sp. heat results for Ni appear to be in general agreement with the theoretical treatment.   G. D. P.

Incomplete rotational excitation in diatomic gases at ordinary temperatures and pressures. B. LEWIS and G. VON ELBE (J. Chem. Physics, 1939, **7**, 197—198).—An experiment, involving the measurement of the ratio of the sp. heats for O_2, N_2, and CO, is described which indicates incomplete rotational excitation in these gases at ordinary temp. and pressure.   W. R. A.

Thermodynamic functions of cyanogen and the cyanogen halides. D. P. STEVENSON (J. Chem. Physics, 1939, **7**, 171—174).—The free energy function, heat content, and heat capacity have been calc. for $(CN)_2$, CNCl, CNBr, and CNI for a series of temp. (250—1000° K.) from spectroscopic and electron diffraction data. In CNI the C—I distance, obtained by extrapolation from the C—Cl and C—Br distances, is 1.96 ± 0.04 A. The free energies of formation $\Delta F^{\circ}_{298\cdot1}$ of gaseous $(CN)_2$, CNCl, and CNI, calc. from thermal and equilibrium data, are 69.1, 35.5, and 46.75 kg.-cal. per mol., respectively. $\Delta F^{\circ}_{298\cdot1}$ for gaseous CNBr is estimated as 40 kg.-cal. per mol.   W. R. A.

Heat capacity of crystalline tellurium from 15° to 300° K. and the entropy at 298·1° K. C. M. SLANSKY and L. V. COULTER (J. Amer. Chem. Soc.,

1939, 61, 564).—Heat capacity data are recorded. The entropy is $11\cdot88\pm0\cdot10$ c.u. E. S. H.

Specific heats of manganese nitrides. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **35**, 24—31).—The Mn–N system of alloys was prepared and the mean sp. heat was determined by means of an ice calorimeter over the ranges 0—99·5°, 0—305°, and 0—500·3°. The equations for the true sp. heats within these limits are : Mn_3N_2 $C = 0\cdot1468 + 1\cdot168 \times 10^{-4}\theta + 4\cdot992 \times 10^{-9}\theta^2$; Mn_5N_2 $C' = 0\cdot1382 + 1\cdot112 \times 10^{-4}\theta + 1\cdot630 \times 10^{-8}\theta^2$; Mn_3N_2 $C'' = 0\cdot1280 + 1\cdot106 \times 10^{-4}\theta + 3\cdot651 \times 10^{-8}\theta^3$. A. J. M.

Supersonic velocity in gases and vapours. VI. Specific heats of the vapours of alcohols and ethyl acetate. S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 39—58).—Supersonic velocity data in MeOH, EtOH, $Pr^\alpha OH$, $Pr^\beta OH$, $Bu^\gamma OH$, and EtOAc at 97·1° and 134° are recorded together with calculations of the sp. heats. Differences between these vals. and those calc. from calorimetric and spectroscopic data are discussed with reference to mol. structure. C. R. H.

Supersonic velocity in gases and vapours. VII. Specific heats of the vapours of dichloromethane, chloroform, carbon tetrachloride, and ethylene dichloride. S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 59—78).—Supersonic velocities (v) have been measured over a range of 50—127 khz. at 97·1° and 134° in the vapours of CH_2Cl_2, $CHCl_3$, CCl_4, and $C_2H_2Cl_2$. $CHCl_3$ shows appreciable dispersion at the higher frequency. The mol. heats of CH_2Cl_2, CCl_4, and $C_2H_4Cl_2$ vapours, calc. from v, agree with those calc. from spectroscopic data; $CHCl_3$, however, shows a diminution of mol. heat by ~3·8 g.-cal. at both temp. owing to a definite transition in v. This behaviour is similar to that of $Pr^\beta OH$ (see above). Both mols. are of the AXB_3 type, and it is probable that the rotational sp. heats are degraded owing to gyration on the A–X axis. W. R. A.

Critical and co-operative phenomena. III. Theory of melting and the structure of liquids. J. E. LENNARD-JONES and A. F. DEVONSHIRE (Proc. Roy. Soc., 1939, A, **169**, 317—338; cf. A., 1938, I, 130, 352).—The theory developed previously is extended to include the process of melting by introducing the idea of disorder. A solid is pictured as an alloy of atoms and "holes," the atoms occupying the sites of a perfect lattice and the holes the sites of a similar lattice interpenetrating the first. As the temp. rises the atoms leave their normal sites and occupy holes, producing a degree of disorder in the solid. The m.p., change of vol., and latent heat of fusion are calc. in terms of the extra energy associated with the transfer of an atom to a hole. Numerical vals. for A and N_2 are in good agreement with experiment. The vals. of the b.p. and heats of vaporisation of A and N_2 are re-calc. and now agree better with observation. G. D. P.

M.p. alternation of the higher triglycerides [of single fatty acids]. W. GRÜNTZIG (Z. anorg. Chem., 1939, **240**, 313—321).—The work of Clarkson and Malkin (A., 1934, 720) is discussed and compared with that of Weygand and Grüntzig (A., 1932, 798, 799) and additional data on trilaurin and tri-tridecoin are given. Clarkson and Malkin's γ- and α-forms are identified with the author's IIIC and IIC forms respectively, whilst their β-forms are identified with the IA forms for the glycerides of acids having an even no. of C, and with the IIA forms for those of acids having an odd no. of C. Photomicrographs and preparative details of the various forms are given. The m.p. ranges for trilaurin and tri-tridecoin are 15—46·5° and 24—44·4° respectively. F. J. G.

Cohesion of simple compounds. I, II. J. M. STEVELS (Rec. trav. chim., 1939, **58**, 229—243, 244—256).—I. Theoretical. A method for calculating the b.p., T_S, of CH_4, C_2H_6, and C_2H_4 derivatives containing H is developed. T_S is regarded as being made up of a non-polar London contribution, T_L, and of a contribution due to the interaction of the rigid charge distribution over the mol. which may give rise both to an orientation or Keesom effect, T_K, and to a polarisation or Debye effect, T_D. Part of the real Keesom contribution is included in T_L so that T_K' is the difference between T_K and that part of the Keesom effect included in T_L. For fully halogenated derivatives $T_K' = 0$. For the chlorides, bromides, and iodides of the types CH_3X, CH_2X_2, and CHX_3, $T_D + T_K'$ has const. vals. ~32, 48, and 45, respectively.

II. Recorded T_S data for halogen derivatives of CH_4, C_2H_6, and C_2H_4 agree satisfactorily with calc. vals. C. R. H.

The Trouton–Deprez rule. Molecular association at the critical temperature. P. BOGDAN (Rocz. Chem., 1938, **18**, 382—388).—The expressions $\lambda/T = 1\cdot98\phi\theta/\upsilon T$, $\lambda/T = K\phi\theta/\upsilon T$, and $\lambda/T = 9\cdot14 \log 82T/V$ are derived, and applications of the formulæ are given. R. T.

Liquid helium. J. F. ALLEN and H. JONES (Nature, 1939, **143**, 227—230).—Recent experiments on transport effects in liquid He are summarised. Equilibrium properties of liquid He are also described. L. S. T.

Tension of saturated vapours. (A) A. M. REGIRER. (B) J. K. SIRKIN (J. Phys. Chem. Russ., 1938, **12**, 154—155, 155).—A discussion of priority (cf. A., 1938, I, 394). J. J. B.

Van der Waals forces and the vapour pressures of ortho- and para-hydrogen and ortho- and para-deuterium. K. COHEN and H. C. UREY (J. Chem. Physics, 1939, **7**, 157—163).—Mathematical. W. R. A.

Influence of the interaction of more than two molecules on the molecular distribution-function in compressed gases. J. DE BOER and A. MICHELS (Physica, 1939, **6**, 97—114).—A rigorous calculation of the mol. density-distribution function can be made by taking interactions with increasing no. of mols. successively into account. This is calc. to the second approximation for a Lennard-Jones potential field, and compared with experimental data for liquid Hg, Ga, Na, and K. Agreement is satisfactory. Vals. of the third virial coeff. are calc. and compared with data for N_2 and A. L. J. J.

Phase equilibria in hydrocarbon systems. XXIII. Joule–Thomson coefficient of methane.

R. A. BUDENHOLZER, B. H. SAGE, and W. N. LACEY (Ind. Eng. Chem., 1939, **31**, 369—374).—The Joule–Thomson coeff. of CH_4 has been determined from $21.1°$ to $104.3°$ at pressures from atm. to 1500 lb. per sq. in. It decreases with increasing temp. and reaches a max. at 250—500 lb. per sq. in. at all temp. The data indicate a finite val. at infinite dilution in accord with kinetic theory. Vals. of c_p, H, and compressibility factor as functions of pressure and temp. are calc.   W. A. R.

Adiabatic and isothermal compressibilities of liquids. N. M. PHILIP (Proc. Indian Acad. Sci., 1939, **9**, A, 109—120).—Using a glass piezometer the adiabatic compressibility, $(\delta v/\delta T)_p$ ($v =$ sp. vol.), and C_p have been measured for 24 carefully purified liquids. The isothermal compressibilities and ratios of sp. heats have been calc. Calc. and observed vals. of the intensity of light scattering in the liquids are in good agreement.   W. R. A.

Transport phenomena in the cage model of liquids. R. ŠIMHA (J. Chem. Physics, 1939, **7**, 202).—A formula is derived for the internal friction of a simple quasi-cryst. liquid on the basis of the liquid cage model.   W. R. A.

Coefficients of viscosity of gases. V. D. MAJUMDAR and M. B. VAJIFDAR (J. Univ. Bombay, 1938, **7**, 27—36).—Using a modification of Wagstaff's apparatus (Phil. Mag., 1923, **45**, 84) the following vals. of η (c.g.s. units $\times 10^7$) at 23° have been found : CO_2, 1479.9 ± 0.5; O_2, 2038.33 ± 0.56; N_2, 1767.83 ± 0.37. For N_2 the temp. correction is $\eta_{23°} = \eta_{0°} + 0.000000460(23 - 0)$.   W. R. A.

Measurements of the viscosity of liquid helium. II. W. F. GIAUQUE, J. W. STOUT, and R. E. BARIEAU (J. Amer. Chem. Soc., 1939, **61**, 654—661; cf. A., 1938, I, 446).—Formulæ have been developed for isothermal laminar flow when He enters the channel as a liquid and leaves as a gas. Liquid He has η 2.0×10^{-5} poise at $2.266°$ K. and 1.0×10^{-7} poise at $1.468°$ K. The largest Reynolds no., at $1.468°$ K., is about 200. η appears to approach 0 at $0°$ K.   E. S. H.

Rate of viscous flow of metals. II. Lead. L. C. TYTE (Proc. Physical Soc., 1939, **51**, 203—221; cf. A., 1938, I, 241).—Investigations over a wide load range from room temp. to 300° show that for very small extensions the velocity of viscous flow v is not wholly independent of time. As soon as the non-viscous flow ceases to have appreciable effect, v is connected exponentially with the stretching load P for any given temp. and exponentially with T for any given load; expressions relating v, P, and T are obtained from the flow–load curves. Four sets of consts. attributable to single or double glide in untwinned and in twinned crystals, extension during the recrystallisation period and production of annealing twins, and extension when strain-hardening is considerably diminished by self-annealing are obtained. The elastic limit and transition and breaking loads are connected hyperbolically with the corresponding temp. The behaviour of Pb wire is in general agreement with results for single crystals and with those for Sn.   N. M. B.

Self-diffusion in liquid hydrogen. E. CREMER (Z. physikal. Chem., 1939, **42**, B, 281—287).—The diffusion const. in liquid H_2 can be measured by measuring the fall in p-H_2 in liquid H_2 above a layer of solid O_2, and by studying the course of v.p. of liquid mixtures of H_2, HD, and D_2, which is ultimately due to diffusion in the liquid phase. The diffusion consts. thus obtained ($D_{20} = 0.01$ and 0.02 sq. cm. per day respectively) are $\leqslant$ that given by the formula valid for the gas phase. The difference is explained by considerations of energy barriers.   W. R. A.

Diffusion of radon gas mixtures. W. HIRST and G. E. HARRISON (Proc. Roy. Soc., 1939, **A**, 169, 573—586).—Diffusion measurements were made on gas mixtures containing Rn mixed with H_2, He, Ne, A, and air. The repulsive forces between Rn–H_2 and Rn–He are evaluated, and it is inferred that the Rn mol. is very " soft." Experimental difficulties, due to the adhesion of Rn to the walls of the diffusion apparatus, and their elimination are discussed.   G. D. P.

X-Ray study of benzene-*cyclo*hexane mixtures. G. E. MURRAY and B. E. WARREN (J. Chem. Physics, 1939, **7**, 141—143).—X-Ray diffraction patterns for C_6H_6, *cyclo*hexane (I), and three mixtures containing 25, 50, and 75 vol.-% of (I) using Cu $K\alpha$ radiation are given. Peaks occur for C_6H_6 ($\sin \theta/\Lambda = 0.1057$) and (I) ($\sin \theta/\Lambda = 0.0996$), but no resolution into two peaks is observed for the mixtures; one peak only is visible, the position of which shifts with the composition. The data for the mixtures are considered in relation to the emulsion type of structure postulated by Ward (cf. A., 1936, 587), but are insufficient to prove or disprove the theory.   W. R. A.

Diamagnetism of some organic liquid mixtures. S. R. RAO and A. S. NARAYANASWAMY (Proc. Indian Acad. Sci., 1939, **9**, A, 35—66).—The diamagnetic susceptibility χ of binary mixtures of HCO_2H and AcOH with H_2O, MeOH, EtOH, $COMe_2$, and Et_2O have been investigated by the Gouy method. Physical data (saturation v.p., n, and d of the pure liquids and liquid mixtures) are also recorded. Whilst considerable variations from additivity are evident for d and n, only slight deviations are observed in χ. Deviations in χ, which do not seem to depend directly on the electric moments of the mols. concerned, are due probably to interaction effects between the mols. This is supported by Seely's observation that the deviations are dependent on temp. (cf. A., 1936, 931).   W. R. A.

Frequency of the hydroxyl group in binary mixtures. II. Combination spectrum of solutions of methyl alcohol in carbon tetrachloride and chloroform. V. I. MALISHEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 549—550; cf. A., 1938, I, 342).—In increasingly dil. solutions of MeOH in CCl_4 the broad band 3362 cm.$^{-1}$ is progressively replaced by a sharp line 3647 cm.$^{-1}$, due to isolated MeOH mols. In $CHCl_3$ the line is 3630 cm.$^{-1}$ and the band appears only at high concn.   L. J. J.

Refractometric study of the system benzene-*cyclo*hexane–carbon tetrachloride. C. MICHALE-WICZ (Rocz. Chem., 1938, **18**, 718—724).—The d- and n-composition diagrams are given for 20°.

Deviations from the addition rule are > would be expected from d changes.   R. T.

Dielectric constant of conducting solutions. H. M. GRUBB and H. HUNT (J. Amer. Chem. Soc., 1939, **61**, 565—569).—Dielectric consts. of dil. aq. KCl, K_2SO_4, and $MgSO_4$ have been determined at 25°. A theory is put forward, which accords with the data and explains discrepancies in the results of other investigators.   E. S. H.

Relation between properties of mixed and single solutions. III. Heat capacity and density of solutions in the system $NaCl + KNO_3 = NaNO_3 + KCl$. A. B. ZDANOVSKI. **IV. Heat capacity of aqueous solution of salts in the system $MgSO_4 + 2NaCl = MgCl_2 + Na_2SO_4$ at 25°.** A. B. ZDANOVSKI and K. D. SUSLINA (J. Phys. Chem. Russ., 1938, **12**, 105—108, 109—112; cf. A., 1939, I, 68).—III. When two solutions having equal v.p. are mixed the heat capacity of the mixture is additive.

IV. This rule may be applied to calculating the C_p of salt waters.   J. J. B.

Anomalies in aqueous solutions of potassium chloride and lead chloride. H. N. PARTON, R. A. ROBINSON, and A. J. METSON (Trans. Faraday Soc., 1939, **35**, 402—412).—Redeterminations of physical properties of aq. solutions of KCl with and without $PbCl_2$ indicate that the abnormalities found by Baxter *et al.* (A., 1911 ii, 557) for ρ and n of aq. KCl, by Hunter and Allmand (A., 1936, 429) and by Weir (*ibid.*, 678, 682) for the v.p. for the mixed solutions and for aq. KCl respectively, and by Burrage (A., 1932, 810) for the solubility of $PbCl_2$ in aq. KCl are to be attributed to experimental difficulties. Vals. of ρ for 0·4—1M-KCl agree very closely with those calc. by Root's formula with Wirth's const. (A., 1938, 1, 78).
    F. L. U.

Viscosity of aqueous solutions of strong electrolytes. J. D. RANADE and G. R. PARANJPE (J. Univ. Bombay, 1938, **7**, 41—59).—Using a quartz viscosimeter vals. for η for aq. solutions of LiCl, NaCl, KCl, NH_4Cl, $CaCl_2$, and $BaCl_2$ ranging from 0·1M. to 0·01M. at ~35°, 45°, and 55° have been determined and are discussed from the viewpoint of various existing theories.   W. R. A.

Diffusion coefficient of potassium molybdo-octacyanide and ferrocyanide. S. PLEŚNIEWICZ (Rocz. Chem., 1938, **18**, 740—742).—The diffusion coeffs. at 20° are 0·863 for $K_4Mo(CN)_8$ and 0·86 for $K_4Fe(CN)_6$. These results support the view that the diameter of ions is a function of their valency.
    R. T.

Diffusion of iron salts in aqueous solution. L. W. ÖHOLM (Finska Kem. Medd., 1939, **48**, 23—34).—D^{20} into H_2O has been determined for aq. solutions of $FeCl_2$, $FeCl_3$, $FeSO_4$, $Fe_2(SO_4)_3$, and $Fe(NO_3)_3$ from 0·1 to 4·0N.   M. H. M. A.

Diffusibility of dyes. J. FAUTREZ and L. LISON (Protoplasma, 1937, **27**, 169—189).—Where great accuracy is not required the micro-method of Fürth and Nistler is very satisfactory and gives an indication of the uniformity of size of particles. Great caution must be observed in attempting to calculate particle size from diffusion data. The diffusion coeffs. of 83 dyes are determined. Diffusibility varies with concn.
    M. A. B.

Specific gravities of liquefied ammonia solutions of ammonium and sodium chlorides. S. KIKUTI (J. Soc. Chem. Ind. Japan, 1939, **42**, 15—17B).—The sp. gr. of solutions in liquid NH_3 of NH_4Cl and NaCl, and of mixtures of these salts in the proportions 1 : 2, 1 : 1, 2 : 1, 4 : 1, and 8 : 1, are given for concns. from zero to saturation, and temp. from —30° to 70°.   W. A. R.

Solid solutions of calcium and barium orthosilicates. N. A. TOROPOV and P. F. KONOVALOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 663—664).—Microscopic examination of the binary system $2CaO,SiO_2$–$2BaO,SiO_2$, prepared by fusion of the requisite amounts of $CaCO_3$, $BaCO_3$, and SiO_2, indicates a single homogeneous phase. The n and the sp. gr. of the mixed crystals increase with increase in $[2BaO,SiO_2]$.   W. R. A.

Fine structure of glasses. I. Molecular refraction of binary phosphate-, silicate-, and borate-glasses. E. KORDES (Z. anorg. Chem., 1939, **241**, 1—38).—ρ and n have been determined for a series of glasses in each of the systems PbO–B_2O_3, ZnO–B_2O_3, CdO–B_2O_3, PbO–SiO_2, PbO–P_2O_5, and also for some cryst. Pb silicates. The curves of $[R]$ against composition are not linear except in the PbO–P_2O_5 system. Their course can be accounted for in terms of individual ionic refractivities if account is taken of the deformation of the O'' ion by the highly-charged cations, so that different refractivities are assigned to O'' ions according to their occurrence in such groupings as (*e.g.*) Si–O–Si, Si–O–Pb, or Pb–O–Pb.   F. J. G.

Molecular refraction of glasses. W. BILTZ and F. WEIBKE (Z. anorg. Chem., 1939, **241**, 39—41). —There is no essential difference between the conclusions of Kordes (preceding abstract) and those of Biltz *et al.* (A., 1938, I, 13).   F. J. G.

Crystalline silica in devitrified glasses.—See B., 1939, 379.

Elastic properties of Jena glasses.—See B., 1939, 378.

Change in electrical conductivity of glass during devitrification.—See B., 1939, 379.

Entropy changes on melting intermediate phases in binary alloys. C. WAGNER (Z. Metallk., 1939, **31**, 18).—The entropy change on melting an intermediate phase in a binary system is ~1·3 g.-cal. per °c. > that on melting the pure metals owing to the change from order to a degree of disorder.   A. R. P.

Course of the melting curves in the equilibrium diagram of bronzes. U. DEHLINGER (Z. Metallk., 1939, **31**, 17—18).—The empirical relation between the liquidus curves within the solid solution range of various Cu- and Ag-rich binary alloys found by Hume-Rothery is shown from thermodynamic principles to be of general validity only when solvent and solute metal are in the same horizontal period of the periodic table.   A. R. P.

Diffraction of X-rays by age-hardening aluminium-copper alloys. G. D. PRESTON (Proc. Roy. Soc., 1938, **A**, **167**, 526—538).—An X-ray examination of single crystals of an alloy of Al with 4 wt.-% Cu shows that during the hardening of the quenched alloy the Cu separates in thin sheets on the (100) planes of the Al matrix. (Cf. A., 1939, I, 18.)
G. D. P.

Alloys of gallium with gold. F. WEIBKE and E. HESSE (Z. anorg. Chem., 1939, **240**, 289—299).—The system Au–Ga has been studied by means of cooling-curves, photomicrography, and X-rays. In addition to $AuGa_2$ (A., 1937, I, 296) there exist a compound $AuGa$ and three mixed-crystal phases, α, β, and γ. The α-phase contains up to 26·1 at.-% of Ga at 352°, the solubility decreasing with falling temp. to approx. 10 at.-% Ga at room temp., and the lattice const. differs only very slightly from that of Au. The β-phase is formed peritectically at 352°. It contains 26·5—29·2 at.-% Ga, and breaks up into α and γ below 275°. The γ-phase is formed by reaction between β and $AuGa$ in the solid phase at 286°, and extends from 29·8 to 30·8 at.-% Ga. $AuGa$ and $AuGa_2$ melt at 468° and 492°, respectively, and do not form mixed crystals with their components.   F. J. G.

Thermal expansion of nickel–copper alloys at low temperatures. I. S. AOYAMA and T. ITÔ (Sci. Rep. Tôhoku, 1939, **27**, 348—364).—The thermal expansion (α) of Ni–Cu alloys has been measured between 0° and −196°. α decreases with increase in Ni content and is < the vals. calc. by the mixture rule. The para- and ferro-magnetic solid solutions give slightly different vals. of α. The anomalies for Cu and Ni reported by Simon and Bergmann (A., 1930, 986) were not observed.   F. J. L.

Correlation between time of transformation and chemical composition of a system approaching equilibrium. I. I. KORNILOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 437—449).—Isothermal transformation processes in metallic alloys are in many cases kinetically similar to unimol. reactions. The rate of polymorphic transformation in Mg–Cd solid solutions depends on composition and temp.
L. J. J.

Variations in resistance of tin–thallium alloys at low temperatures. E. KURZYNIEC (Rocz. Chem., 1938, **18**, 651—659).—Resistance of Sn–Tl alloys at 20·3° and 77·2° K. rises sharply from 0 to 0·4 at.-% Tl, then gradually to a max. at 70 at.-% Tl, above which it falls sharply to the val. for pure Tl. The composition–sp. conductivity diagrams are given for 0°, −196°, and −252·9°.   R. T.

Space lattice of the ζ-phase in the iron–zinc system. F. HALLA, R. WEIL, and F. GÖTZL (Naturwiss., 1939, **27**, 96).—Crystallographic and X-ray investigations of the ζ-phase of Fe–Zn show it to have a monoclinic elementary cell with a 13·65, b 7·61, c 5·06 A., β 128° 44′; 28 atoms (2 mols. $FeZn_{13}$) per cell. The space-group is C_2^3—$C2$, or C_{2h}^3—$C2/m$.
A. J. M.

X-Ray structural analysis: its bases and application to the system Fe–Zn. F. HALLA (Arh. Hemiju, 1939, **13**, 1—9).—X-Ray analysis of crystal structure is illustrated.   R. T.

Crystals of ferro-silicon. N. N. KURNAKOV and G. B. BOKI (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 919—924).—Three types of crystals, viz., trigonal prisms with approx. 45% of Si, tetragonal plates with approx. 54% of Si, and trigonal plates with ≯87% of Si, are described and compared, and the conditions for their formation are discussed.
F. J. G.

Longitudinal magneto-resistance effect at various temperatures in iron–silicon alloys. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1939, **27**, 255—277; cf. A., 1938, I, 569).—The max. val. of $\Delta R/R$ is at −100°, and is displaced to higher temp. with increase in Si. It is negative in all alloys containing >9·43% Si.   F. J. L.

X-Ray analysis of alloys of the nickel–silicon system. A. ÔSAWA and M. ÔKAMOTO (Sci. Rep. Tôhoku, 1939, **27**, 326—347).—The crystal system and lattice consts. of all the phases of the Ni–Si system of alloys are determined. α-phase (0—5% Si) is face-centred cubic, a 3·517—3·510 A. $β_1$-phase has the composition Ni_3Si and is face-centred cubic, space-group O_h^1, a 3·497 A. γ-phase, Ni_5Si_2, is hexagonal, a 13·29, b 7·672, c 9·752 A. δ-phase, Ni_2Si, is orthorhombic, a 7·39, b 9·90, c 7·04 A.; 16 mols. of Ni_2Si in the unit cell. θ-phase, Ni_2Si, is hexagonal, a 3·797, c 3·893 A. ε-phase, Ni_3Si_2, is orthorhombic, a 6·605, b 7·627, c 9·574 A. η-phase, $NiSi$, is tetragonal, a 7·654, c 8·451 A. ζ-phase, $NiSi_2$, is rhombohedral, a 8·881 A., α 90° 23·6′. ζ′-phase, $NiSi_2$, is probably not obtainable at room temp. and the X-ray diagrams were almost the same as those of the ζ-phase. The lattice const. of pure Si is 5·409 A. The method of isolating each phase is described.
F. J. L.

Tantalum–iron alloys. V. A. NEMILOV and N. M. VORONOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 905—912).—The findings of earlier workers are discussed (cf. A., 1935, 1199; Harrison, B., 1937, 46). The system has been studied by means of thermal analysis and photomicrography, and by measurements of hardness and of electrical resistance, from 0 to 34·2% Ta. The eutectic at ~1410° with 10·1 at.-% Ta consists of FeTa + solid solution.
F. J. G.

Existence of a two-phase region in the ordering process. R. HULTGREN (J. Chem. Physics, 1939, **7**, 202—203).—Thermodynamically in superlattice formation a two-phase region should separate the ordered and disordered states at all compositions except the most stable one. This idea has been tested for the system Fe–Pd by approaching the equilibrium from both sides. A rather wide two-phase region appears to exist in the Fe–Pd superlattice in samples containing 51·9 at.-% Pd. Experiments are described which, however, indicate that, at 690°, disorder is probably the equilibrium condition and the two-phase sample represents an incomplete reaction.
W. R. A.

Solid solution series Ag_3Ga–$AgZn$ in ternary system silver–gallium–zinc. K. MOELLER (Z. Metallk., 1939, **31**, 19—20).—The low-temp. modifications of Ag_3Ga and $AgZn$ form a continuous series of solid solutions since the two compounds are iso-

morphous and have a valency-electron ratio of 3 : 2. At high temp. the solid solution shows lines in the X-ray spectrum attributable to a close-packed hexagonal lattice.   A. R. P.

Mixed crystal series in the ternary systems Ag–Mn–Zn and Cu–Mn–Zn. K. MOELLER (Naturwiss., 1938, 27, 176).—X-Ray and microscopic investigations show that ternary mixed crystals can be formed between the binary Mn–Zn phase and the hexagonal ε-phases of the binary systems Ag–Zn and Cu–Zn.   A. J. M.

Ternary alloys containing magnesium and cadmium and the equilibrium diagram of binary magnesium–cadmium alloys. II. E. JÄNECKE [with L. NEUNDEUBEL and K. RUMPF] (Z. Metallk., 1938, 30, 424—429).—A re-examination of the Cd–Mg system has shown the presence of three intermediate phases, all of which undergo a transformation on cooling and none of which appears to correspond with a simple intermetallic compound. The transformation temp. in all three phases varies with the composition, that of the β-phase increasing from 130° at 19—22 at.-% Cd to 180° at 35—39 at.-% Cd, that of the γ-phase rising from 180° (39 at.-% Cd) to a max. of 250° at 50 at.-% Cd and then falling to 120° at 65 at.-% Cd, and that of the δ-phase falling from 120° at 65—73 at.-% Cd to 90° at 79—81 at.-% Cd. There are narrow two-phase regions separating the five phases of the system from one another and peritectic horizontals at 530° (18—21 at.-% Cd), 442° (38—42 at.-% Cd), 357° (66—72 at.-% Cd), and 331° (79—81 at.-% Cd). Addition of Al to the Cd–Mg alloys depresses the temp. of these reactions to 420° (23 at.-% Al), 407° (17 at.-% Al), 340° (5 at.-% Al), and 320° (2 at.-% Al), respectively, and forms a ternary eutectic at 398°, Mg 48, Al 20 at.-% ; a wide area of incomplete miscibility extends from the Al–Cd side to a crit. point at Cd 37, Al 40, Mg 23 at.-%, 510°. Addition of Zn to the Cd–Mg alloys depresses the peritectic temp. to 340° (20 at.-% Zn), 345° (12 at.-% Zn), 345° (11 at.-% Zn), and 280° (15 at.-% Zn) respectively. Some modifications are also made at the Mg corner of the Tl–Mg–Cd diagram. (Cf. A., 1939, I, 70.)   A. R. P.

Phase diagram for [the system] iron–nickel–chromium with special reference to the brittle constituents produced by long heating. P. SCHAFMEISTER and R. ERGANG (Arch. Eisenhüttenw., 1939, 12, 459—464; cf. B., 1932, 469; A., 1937, I, 508).—Published data have been extended by delineation of the complete isotherms for 650° and 800°, the mixes being melted at 1200° and then heated for 1000 hr. at the lower temp. to ensure attainment of equilibrium. The region of existence of the pure " σ-phase," which is brittle, hard, and non-magnetic, is illustrated by two perspectives of the solid triangular diagram. It extends tunnelwise from the Fe–Cr system through the heterogeneous α + γ region.   R. C. M.

Absorption of gas in the form of bubbles. Y. ÔYAMA and K. IWASE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 35, 131—157).—A mixture of 36% CO_2 in air is passed up through a long column of dil. NaOH, the size of the bubbles being controlled.

The % of CO_2 absorbed is a min. for bubbles between 0·8 and 1·1 c.c., the actual size varying slightly with [NaOH]. With a 90-cm. column of solution this min. is ~40, 75, and 90% respectively in 0·01, 0·1, and 0·25N-NaOH ; increasing the bubble size to 1·6 c.c. or decreasing it to 0·3 c.c. increases the amount absorbed by approx. 10%. The rate of absorption by bubbling is from 10 to 20 times that in the batch method. The mechanism of the absorption is discussed.   D. F. R.

Solubility of ozone in water and in aqueous sodium chloride ; calculation of the solubility of atmospheric ozone in water. E. BRINER and E. PERROTTET (Helv. Chim. Acta, 1939, 22, 397—404).—The solubility of O_3 in H_2O from air containing 0·03—0·9% of O_3 obeys Henry's law, the absorption coeff. (α) being 0·480 at 3·5° and 0·323 at 19·8°. The calc. heat of dissolution is 3904 g.-cal. Vals. of α and of the solubility are calc. for various temp. between 0° and 60°. For O_3 in 3·5% NaCl, α is 0·24 at 3·5° and 0·17 at 19·8°. Air dissolved in H_2O should be 20 times as rich in O_3 as atm. air.   J. W. S.

Mixtures of methyl alcohol and carbon disulphide (binary system with two liquid phases) and methyl alcohol and carbon tetrachloride (miscible in all proportions). Infra-red absorption spectra. H. GERDING and R. FREYMANN (J. Chim. phys., 1939, 36, 19—22).—Infra-red absorption measurements show that the intensity of the $(OH)_v$ band (characteristic of non-associated mols.; cf. A., 1937, I, 282) of MeOH is greater in CCl_4 than in CS_2, and that the position of the band in CCl_4 is nearer to that observed in MeOH vapour. These results are in harmony with the view that in CS_2 the MeOH is more associated than in CCl_4, and that the formation of two liquid phases is closely related to this association.   F. L. U.

Relation between solubility of crystals and their size during deposition from solution. E. HOFER (Z. physikal. Chem., 1939, 183, 455—461).—Experiments with several inorg. salts suggest that the average size of deposited crystals is ∝ (solubility)².
                C. R. H.

Solubility of sodium amide in liquid ammonia. S. SIGETOMI (J. Soc. Chem. Ind. Japan, 1938, 41, 409B—410B).—The binary system $NaNH_2$–NH_3 and the ternary system $NaNH_2$–NaCl–NH_3 have been investigated from —20° to 20°. Addition of NaCl or $NaNH_2$ increases the solubility of the other.   K. W. P.

Electrometric determination of the solubility of some hydroxides. G. C. BAUER (Iowa State Coll. J. Sci., 1938, 13, 37—40).—Viscosity, refractive index, absorption spectra, and electrometric titration data for dil. solutions containing Mg and NH_4 salts show no evidence of complex formation. Determination of the p_H of saturated solutions gives results in agreement with accepted vals. for a no. of basic oxides. The solubility of $Sr(OH)_2$ at 25° is 8·55 g. per l.   L. J. J.

Solubility of calcium bicarbonate. II. Partial peptisation. S. S. HUBARD (J. Physical Chem., 1939, 43, 387 ; cf. A., 1938, I, 613).—No evidence

has been obtained for the partial peptisation of $CaH_2(CO_3)_2$ in solution.   C. R. H.

Solubility of strontium chromate. T. W. DAVIS and J. E. RICCI (J. Amer. Chem. Soc., 1939, **61**, 746—748).—Data for 15°, 25°, and 75° are recorded. Equilibrium is reached slowly. A marked decrease in solubility occurs with rising temp.   E. S. H.

Solubility curve of phosphoric acid in citric acid. R. MEURICE (Ann. Chim. Analyt., 1939, [iii], **21**, 61—63).—Curves showing the solubility of pptd. $Ca_3(PO_4)_2$, apatite, and other natural phosphates in concns. of citric acid up to 1% are discussed.   L. S. T.

Factors affecting the time of dissolution of glucose. B. F. BUCHANAN (Iowa State Coll. J. Sci., 1938, **13**, 50—51).—The effects of alkali hydroxides, org. bases, and other catalysts, and of temp., have been examined. Mutarotation catalysts are correspondingly effective as dissolution catalysts.   L. J. J.

Relation between compressibility and solubility of metals in acids. S. BALCE (J. Amer. Chem. Soc., 1939, **61**, 746).—When the compressibility of a metal, calc. from the formula applied to compounds, is < the observed compressibility, the metal displaces H_2 from acids.   E. S. H.

Chemical corrosion of glass.—See B., 1939, 379.

Distribution of bromine between crystals and solutions of potassium chloride and bromide. N. A. SCHLEZINGER, F. P. ZORKIN, and L. N. NOVOSHENOVA (J. Appl. Chem. Russ., 1938, **11**, 1259—1265).—The ratio x/N, where x and $N = [KBr]/\{[KBr] + [KCl]\}$, for aq. KCl–KBr and the crystals separating therefrom, respectively, falls with rising temp. and [KBr], and may be > or <1. The existence of solutions in which [Cl]/[Br] remains const. during crystallisation is postulated; such solutions would be analogues of liquid azeotropic mixtures.   R. T.

Distribution of isomorphous salts during crystallisation of their aqueous solutions. S. K. TSCHIRKOV (J. Appl. Chem. Russ., 1938, **11**, 1245—1258).—The distribution of one of a pair of isomorphous salts between the solid and liquid phases varies according to the difference in solubility and heat and velocity of crystallisation of the salts, and in the adsorptive properties of the solid phases. R. T.

Growth of crystals. IX. Relation between concentration of cations added to solution and their amount in the crystal formed. T. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 1278—1291).—In a transparent crystal of NaCl of which the growth was favoured by the catalytic action of $Mn^{..}$ or $Pb^{..}$, and in that of KCl favoured by $Bi^{...}$, the amount of foreign cation present is given by $x = kc^n$ ($x, c =$ mol.-% of cation in crystal and solution, respectively, k, n consts.). The amount of foreign cations in the crystal varies with the velocity of crystallisation up to a limit. The transparent crystal becomes opaque on heating, suggesting that the foreign cations are hydrated. Cations which catalyse crystal growth are contained in the crystal in amount > 0·01 mol.-%.   A. J. M.

Reciprocal displacement of electrolytes carried down by precipitates. A. PINKUS and A. SALOMON (Bull. Soc. chim. Belg., 1938, **47**, 844—888).—Experiments have been conducted on the displacement by (1) KCl, $MnCl_2$, and $LaCl_3$ of Cu in cryst. $BaSO_4$ pptd. in presence of $CuCl_2$, (2) NaCl, Na_2SO_4, and Na_3PO_4 of Cu in cryst. $BaSO_4$ pptd. in presence of $K_2Cr_2O_7$; (3) H_2O, KCl, Na_2SO_4, $Ba(OAc)_2$, $MnCl_2$, and $LaCl_3$ of Cu in colloidal $BaSO_4$, (4) KCl, $MnCl_2$, and $LaCl_3$ of Cu in $Al(OH)_3$, (5) KCl, NaCl, $NaNO_3$, Na_2SO_4, Na_2CO_3, Na_3PO_4, and Na_3AsO_4 of CrO_4'' and Cr_2O_7'' in $Al(OH)_3$, (6) KCl, NaCl, $CaCl_2$, $LaCl_3$, $AlCl_3$, Na_2SO_4, $MgSO_4$, $ZnSO_4$, and $Al_2(SO_4)_3$ of Mn in As_2S_3. The results show that displacement occurs the more readily the higher is the electrochemical valency of the displacing ion. The conditions for displacement depend on sp. chemical properties of the ppt. and the impurity as well as on the particle size and structure of the ppt. Electrolytes carried down by ppts. are not usually held entirely by simple adsorption; in most cases a part is fixed irreversibly.   E. S. H.

Sorption of gases on reduced nickel. I. Hydrogen, oxygen, and hydrogen bromide. M. TAKEBAYASHI (Bull. Chem. Soc. Japan, 1939, **14**, 47—53).—The rates of sorption of H_2, O_2, and HBr by reduced Ni at 20° have been measured. H_2 sorbed on reduced Ni is slowly desorbed by reduction of pressure. Reduced Ni rapidly becomes saturated with O_2 owing to formation of an oxide film, desorption not being possible. Ni saturated with O_2 takes up more H_2 at 20° or 100° than does freshly reduced Ni; some of the H_2 can be desorbed and more O_2 then taken up. Sorption of O_2 by reduced Ni saturated with H_2 is slightly < that by freshly reduced Ni. The gradual and extensive sorption of HBr on reduced Ni in the dark suggests an activated adsorption. Sorption of HBr by reduced Ni saturated with O_2 is > that by freshly reduced Ni, the increase being due to reaction not with O_2 but with NiO (cf. Urushibara et al., A., 1938, I, 628).   F. H.

Adsorption of oxygen and hydrogen on platinum and the removal of these gases by positive-ion bombardment. C. W. OATLEY (Proc. Physical Soc., 1939, **51**, 318—328).—Measurements of the contact p.d. between a W filament and a Pt anode after the latter had been subjected to various treatments are reported. Successive bombardments of the anode with positive ions of O and A give a clean Pt surface, the work function of which is in good agreement with the most recent data from thermionic measurements. Vals. are obtained for the work functions of O on Pt, H on Pt, and mixed layers of O + H on Pt, and the bearing of these results on the structure of mixed layers is discussed.   N. M. B.

Adsorption by aluminium, iron, and magnesium hydroxide gels of ethyl alcohol, water, and benzene vapours. J. K. NOVODRANOV (Sci. Mem. State Univ. Leningrad, Chem. Ser., 1938, No. 18, 101—126).—Aq. NH_3 was added to aq. Al, Fe, and Mg salts, and the hydroxides were collected, washed, and dried at 100—800°. Adsorption of vapours by the gels varies according to the temp. of drying (max. adsorption of EtOH, H_2O, and C_6H_6 by

Al_2O_3 for 300°, 600°, and 500°, respectively; the corresponding temp. for Fe_2O_3 are 200°, 200°, and 100°, and for MgO gel 100°, 100°, and 100°).
R. T.

Ebulliometric method of measuring adsorption. M. WOJCIECHOWSKI (Rocz. Chem., 1938, **18**, 882—887).—Adsorption of C_6H_6 vapour on glass or Cu (18°) or of H_2O on Pt (20°) is measured ebulliometrically (cf. A., 1935, 876), and amounts, respectively, to 0.26 ± 0.03, 0.34 ± 0.05, and 0.69 ± 0.06 µg. per sq. cm.
R. T.

Dependence of absorbent power of charcoal on duration of contact with the filtering layer. M. ŚWIDEREK (Rocz. Chem., 1938, **18**, 798—803).— The expression $V = K[1 - \sqrt{(t_0/t)}]$ is derived ($V =$ mg. of gas adsorbed per c.c. of filtering layer, at time t; $K =$ max. adsorption in mg. per c.c., at time t_0).
R. T.

Effect of moisture on sorption of carbon tetrachloride from an air stream by activated charcoal. L. J. BURRAGE and A. J. ALLMAND (J.S.C.I., 1938, **57**, 424—431).—The experiments described relate to the breakdown times (t) of four specimens of C of different characteristics when traversed by a const. stream of air containing CCl_4 at 0·9 mm. partial pressure. The H_2O content (whether of the air or of the C in equilibrium with it) was varied between 36 and 73% R.H. With both air and C at the same R.H., t decreases continuously with increase of R.H. With moist C and dry air, t shows usually a decrease, but occasionally an increase, with increase in R.H. With dry C and moist air t is a max. for 65% R.H. The results are attributed to the dual rôle exerted by H_2O, which tends to lower t by competing with the CCl_4, and to increase t by assisting in the removal of the C–O complex from the surface and thus making the C more accessible to the CCl_4.
F. L. U.

Velocity of sorption of gases in porous materials. II. E. WICKE (Kolloid-Z., 1939, **86**, 295—313; cf. A., 1939, I, 195).—The velocity of sorption of CO_2 by activated C and by SiO_2 gel has been measured by a dynamical method. The CO_2 was at a const. partial pressure and was carried by a stream of N_2, the speed of which, as well as the length of the column of sorbent, could be varied. For small rates of flow the adsorption curves are S-shaped and symmetrical, whilst the desorption curves under all conditions are unsymmetrical. The calc. diffusion coeff. of CO_2 in the material during adsorption is ≪ during desorption, the difference, which is unexplained, being due to the carrying gas since it is not found in static experiments with pure CO_2. The desorption curves are expressed by an empirical formula. The adsorption process under dynamic conditions is treated theoretically.
F. L. U.

Sorption of gases and vapours by titania gel. V. Variation in the sorptive capacity of titania gel by the addition of Fe_2O_3 gel and difference between the sorptive capacities of α- and β-titania gels. I. HIGUTI (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 15—26).—The isotherms for the mixed gels for H_2O vapour at 20° consist of two parts, the first being lowered in proportion to the

[Fe_2O_3], and the second being higher than that of either component gel. The first part represents ordinary adsorption and the second capillary condensation. Addition of Fe_2O_3 increases the total pore vol. and renders the gel more stable to heat. A comparison between the sorptive capacities of α-TiO_2 gel with that of the β-gel where the inner surface area is less supports this view.
D. F. R.

Theory of adsorption from solutions. A. A. SCHUCHOVITSKI (J. Phys. Chem. Russ., 1938, **12**, 11—22).—A thermodynamical theory of adsorption from solutions is derived, based on the equality of the adsorptions from a solution and from its saturated vapour. Neither the potential theory of adsorption of vapours, nor that assuming a unimol. adsorption layer, can account for the observed adsorption isotherms. It seems that in the adsorption layer a separation of both components takes place.
J. J. B.

Physicochemical study of liquid surfaces. R. DUBRISAY (Kolloid-Z., 1939, **86**, 273—279).— Mainly a discussion of the validity of Gibbs' adsorption theorem. Data on the fractional adsorption from mixed solutes are presented, which afford qual. support for the theory.
F. L. U.

Density of the surface layer, molecular dimensions, and the Gibbs adsorption equation. G. L. STAROBINETZ (J. Gen. Chem. Russ., 1938, **8**, 1583—1588).—Formulæ expressing the no. of mols. per unit area of the adsorption layer and the radius of 1 mol. are deduced. Adsorption from dil. solution is expressed by $\Gamma = 2(U_0 - U)/L_0$, where U_0 and U are the surface energy in pure solvent and solution, respectively, and L_0 is the mol. latent heat of vaporisation of the solvent.
R. T.

Adsorptive properties of clay (kaolin). V. I. NIKOLAEV and E. I. RUDENKO (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 237—239).—The adsorption of ions by a 99·59% kaolin has been investigated. $Na^{\cdot}$, $K^{\cdot}$, Cl', and Br' were adsorbed, but not SO_4'', $Mg^{\cdot\cdot}$, or $Ca^{\cdot\cdot}$. The sum of $K^{\cdot} + Na^{\cdot}$ adsorbed is equal to $Cl' + Br'$ (in g.-equiv.). These ions are also adsorbed by impure clay but to a somewhat greater extent.
A. J. M.

Adsorption of [potassium] permanganate and dyes by precipitates. C. L. MANKODI and V. S. KHALAP (J. Univ. Bombay, 1938, **7**, 126—131).— The adsorption of $KMnO_4$ by ZnO and Al_2O_3, methylene-blue (I) and malachite-green (II) by $BaSO_4$ and $PbCl_2$, Bismarck-brown (III) by $BaSO_4$ and $BaCO_3$, Congo-red (IV) and benzopurpurin (V) by $BaCO_3$ obeys Freundlich's adsorption equation. $KMnO_4$ colours the adsorbents pink and the colour cannot be washed out by H_2O, EtOH, or $COMe_2$, and the coloured adsorbent gives tests for K and Mn. The dyes colour the adsorbents and (III), (IV), and (V) (colloidal dyes) cannot be washed out with H_2O, EtOH, or $COMe_2$, whilst the crystalloidal dyes (I) and (II) are partly washed out by H_2O and AcOH.
W. R. A.

Molecular state of arsenious oxide in the adsorption layer, as indicated by the adsorption isotherm. G. BIRSTEIN and M. ŁOBANOW (Rocz.

Chem., 1938, **18**, 355—365).—The val. of the exponent $1/n$ of the adsorption isotherms for aq. As_2O_3 at 25° varies according to the nature of the adsorbent, being 1·830 for active C, 0·794 for Fe_2O_3, 0·577 for Al_2O_3, 0·520 for $Al(OH)_3$, 0·468 for $Cr(OH)_3$, and 0·383 for TiO_2. The high val. found for C is explained on the assumption that the adsorption layer contains mols. of As_4O_6.   R. T.

Photoactivation of solids and its effect on adsorption. J. A. HEDVALL and G. COHN (Nature, 1939, **143**, 330—331).—The adsorbing power of CdS for phenolphthalein is decreased by irradiation with white light filtered through aq. $FeSO_4$. Complete suppression of adsorption may be possible under suitable conditions. Similar effects have been obtained with many dyes, and the exchange of certain groups of a dye mol. has a marked effect on the change of adsorption during irradiation.   L. S. T.

Molecular layers. I. LANGMUIR (Proc. Roy. Soc., 1939, **A**, **170**, 1—39).—Pilgrim Trust lecture. A general survey of the properties of monolayers and multilayers and of the experimental technique which these provide for biological study. The nature of duplex films which have two interfaces separated by a thin three-dimensional layer is discussed. The deposition of mono- and multi-layers on plates of metal and minerals and their optical properties are described; reference is made to the production of non-reflecting glass. The formation of monolayers of proteins and their bearing on the cyclol theory of the structure of globular proteins are discussed. The conditioning of stearate multi-layers rendering them capable of absorbing many H_2O-sol. substances is described.   G. D. P.

Formation and structure of multilayers. J. J. BIKERMAN (Proc. Roy. Soc., 1939, **A**, **170**, 130—144). —The possibility of transferring monolayers from H_2O to grooved surfaces and wire gauzes shows that built-up multilayers consist of films stretched between the irregularities of the solid surface. The technique of obtaining multilayers on wire gauze is described and their behaviour is investigated. The frictional force between a H_2O drop and a multilayer was measured and the coeff. of friction found to be inversely $\propto$ the wt. of the drop.   G. D. P.

Investigation of the electrical properties of multilayers. G. GROETZINGER and W. D. HARKINS (J. Chem. Physics, 1939, **7**, 204—205).—A new method has been developed for the investigation of electrical properties of multilayers, especially for the investigation of the mechanism of production of a film potential when X- or Y-multilayers are built up on a metal at different p_H of subsolution.   W. R. A.

Viscosity of two-dimensional systems. Effect of pressure and temperature, and detection of phase transitions in monolayers. W. D. HARKINS and G. E. BOYD (J. Chem. Physics, 1939, **7**, 203—204).—Investigations of the surface viscosity σ of the long-chain normal saturated fatty acids C_{15}—C_{20} indicate that (i) for all pressures up to ~18 dynes per cm. log $\sigma \propto f$ (pressure), (ii) for monolayers σ increases rapidly with the length of the hydrocarbon

chain, (iii) the liquid- or low-pressure condensed films show a Newtonian viscosity, (iv) a liquid-condensed film may undergo a phase transition into a condensed film of low compressibility if f is increased at const. temp., (v) the σ of films in the "solid-plastic" state decreases rapidly as the length of chain increases, (vi) the increase in σ with pressure near the phase transition, liquid-condensed $\rightarrow$ plastic solid condensed, is great for short mols. and small for long mols., (vii) at pressures > transition pressure, the rate of increase of σ decreases and σ finally reaches an approx. const. val., (viii) the σ of liquid-condensed films of acids are $\leqslant$ those of the corresponding alcohols, because mols. are more tightly packed in the alcohol monolayers, (ix) the σ of both acids and alcohols in the "solid-plastic" state are of the same order of magnitude for the same length of mol., (x) the transition, liquid-condensed $\rightarrow$ "solid-plastic," occurs most readily when the no. of C atoms is odd, (xi) the σ of arachidic acid (I) increases 5 times when the temp. is decreased from 25° to 10°, but above 25° decreases less rapidly, and (xii) the σ of a liquid-condensed film of (I) at 10° becomes non-Newtonian at $f > 11$ dynes per cm. whilst the phase transition does not occur until $f = 25$ dynes per cm. The data on the effect of pressure agree well with the theory of Moore and Eyring (cf. A., 1938, I, 452).   W. R. A.

Behaviour of organic solids on the surface of water. G. V. L. N. MURTI and T. R. SESHADRI (Proc. Indian Acad. Sci., 1939, **7**, **A**, 10—16).—With reference to the behaviour on the surface of H_2O of 107 org. solids the latter may be divided into: (1) solids which show vigorous movement, (2) those which move slowly, and (3) those which move very slowly or not at all. From comparison of the behaviour of different compounds, the influence of different groups, e.g., $\cdot CO_2H$, $:CO$, $\cdot OH$, is obtained. Combination movements exhibited by the pairs $CH_2Ph\cdot CO_2H$–camphor and p-$C_6H_4Me\cdot NO_2$–o-$NO_2\cdot C_6H_4\cdot OH$ are described. The % lowering of γ of aq. solutions of a no. of typical compounds are recorded and are compared with the behaviour of the solid substance on the surface of H_2O. The connexion between the two phenomena is discussed.

      W. R. A.

Hydrophil balance studies on high mol. wt. ketones. E. J. HOFFMAN, A. W. RALSTON, and G. E. ZIEGLER (J. Physical Chem., 1939, **43**, 301—307).—Force–area measurements of films of ROH, RMe, $R\cdot C_{17}H_{35}$, $R\cdot C_6H_4Ph$, and $R\cdot C_6H_4\cdot OPh$ ($R = C_{17}H_{35}\cdot CO$) are recorded. The nature of the films has also been studied by means of lycopodium powder and an air-stream. The film of $R\cdot C_{17}H_{35}$ is more compressible than that of RMe, and since RMe is a free-moving film at the highest compression, there must be a high repulsion between its mols. The difference in area between the mols. of $R\cdot C_6H_4Ph$ and $R\cdot C_6H_4\cdot OPh$ at low pressures diminishes as the pressure is increased. This behaviour is attributed to the possession of four unshared electrons by the ether O in $R\cdot C_6H_4\cdot OPh$, as a result of which the O, which exhibits hydrophilic properties, is removed from contact with H_2O on increasing the pressure.   C. R. H.

Action of various radiations on surface films of proteins. A. DOGNON and C. PIFFAULT (Compt. rend., 1939, 208, 907—908).—Irradiation with X-rays (~ 1.5 A.) or ultra-violet rays (Hg lamp) causes a rapid increase in the surface tension of H_2O carrying a surface film of serum-albumin or hæmoglobin, indicating a rapid destruction of the surface film, apparently without any thermal effect. A similar film of rose-Bengal shows no change on irradiation with white or ultra-violet light. The observations are not in accord with Dessauer's theory of the mechanism of the biological action of radiations. J. W. S.

Absence of heat-denaturation of surface solutions of serum-albumin. A. DOGNON and C. PIFFAULT (Compt. rend., 1939, 208, 654—655).—The surface tension (γ) in albumin films on H_2O or Ringer's solution is $<$ that of H_2O, and its variation with temp. is parallel to that of H_2O up to 70°, the limit of observation. No evidence is obtained of the usual modification of the albumin mols. at 55—60°, illustrating the stability of the (probably solid) surface film. Previous boiling causes a further reduction in γ. A. J. E. W.

Molecular interaction in monolayers. III. Complex formation in lipoid monolayers. J. H. SCHULMAN and E. STENHAGEN (Proc. Roy. Soc., 1938, B, 126, 356—369; cf. A., 1937, I, 235).—Two new methods for investigating the process of penetration of monolayers by substances injected into the substrate are described. Mols. containing ring systems such as digitonin, on penetrating a ring structure monolayer such as cholesterol, form only 1 : 1 complexes. A no. of cases of sp. penetration in these systems are examined. The complexes behave as chemical compounds. Rate of decomp. of a complex monolayer at const. pressure follows the unimol. law. Marked differences due to *cis* and *trans* isomerism are obtained on penetration, supporting the concept of interlocking chains. F. B. P.

Structure and physico-chemical properties of surface layers of high-molecular compounds. I. Molecular structure of the surface layers of gelatin gels. V. A. PTSCHELIN and I. I. KOROTKIN (J. Phys. Chem. Russ., 1938, 12, 50—58).—Measurement of contact angles between H_2O, air, and 10% gelatin jelly, or between H_2O, C_6H_6, and jelly, shows that the hydrophilic character of the jelly surface decreases when setting takes place in contact with glass, air, rubber, and paraffin wax, in the order named. The highest hydrophily is shown by a freshly cut section. C_6H_6 gradually renders a gelatin gel hydrophobic. J. J. B.

Film potentials of stearate multilayers and other dielectrics on metal surfaces. W. D. HARKINS and R. W. MATTOON (J. Chem. Physics, 1939, 7, 186—197).—Experimental data indicate that a part of the film potential of an X-multilayer of Ca stearate on a metal is due to a surface charge on the dielectric and a resultant induced charge in the metal. With a Y-multilayer of an even no. of layers, the potential, and presumably the charge, is almost zero. This indicates that the surface of the multilayer becomes charged only when it moves through the surface of the solution without deposition of a new layer. The charge when the X-multilayer moves upwards through the monolayer of Ca stearate under no pressure is $<$ when it moves under pressure. The potential is a function of p_H and of the nature of the positive ions of the subsolution. W. R. A.

Reaction of copper and zinc with aqueous chromic acid. (Ionic, surface, and space film.) E. MÜLLER (Z. Elektrochem., 1939, 45, 242—248).—It is suggested that when Cu is immersed in aq. H_2CrO_4 it becomes coated with a closely packed unimol. film of $Cr(OH)CrO_4$, oriented so that the $Cr(OH)$ group is next to the metal and the CrO_4 in contact with the solution. The pores are supposed to be permeable to $H^·$ ions, but to permit penetration of anions only under the influence of an applied e.m.f. Therefore, after immersion in H_2CrO_4, Cu is not attacked readily in H_2SO_4 or HCl unless an e.m.f. is applied. A similar film is supposed to be formed on Zn, but in this case the p.d. between the metal and solution is sufficient to cause penetration of the film by any SO_4'' or Cl' ions present. Hence, although reaction between Zn and H_2CrO_4 ceases rapidly, addition of HCl or H_2SO_4 causes continued attack without application of an e.m.f. The theory is confirmed by observations of the electrode potentials of Cu and Zn in H_2CrO_4 under various conditions. J. W. S.

Origin and structure of electrolytically produced aluminium oxide layers. W. BAUMANN (Z. Physik, 1939, 111, 708—736).—The conditions of formation and physical properties of the three distinct types of Al oxide surfaces are discussed in relation to the redissolving power of the electrolyte, and the type and magnitude of current. The properties of the thicker porous layers are treated in detail. L. G. G.

Artificially prepared surface layers on glass. A. VAŠIČEK (Kolloid-Z., 1939, 86, 288—295).—A method is described in which a polarisation spectrometer is used to detect changes in the optical properties of glass surfaces due to the presence of thin layers. Immersion in N-H_2SO_4 causes the deposition of a layer 0·1—0·2 μ. thick, which protects the underlying glass from further attack. No protective layer is formed by N-NaOH, which on the contrary removes that formed by H_2SO_4. No detectable alteration of a SiO_2 surface is caused by either NaOH or H_2SO_4. F. L. U.

Decrease of surface tension of solutions with time. A. BOUTARIC and (MLLE.) P. BERTHIER (J. Chim. phys., 1939, 36, 1—4).—The surface tension of a solution at any time t can be represented by $\gamma = L + (\gamma_0 - L)e^{-at}$, where γ_0 is the initial val., L the val. for $t = \infty$, and a is a const. The formula is verified for solutions of saponin of different concn. F. L. U.

Influence of hydrion concentration on the dielectric potential and surface tension of solutions of valeric, hexoic, octoic, and nonoic acid. L. CHROMY (Rocz. Chem., 1938, 18, 434—438).—Parallel variations in the dielectric potential V and the surface tension γ of the dil. aq. acids are observed as the p_H is varied from 3 to 9. The p_H at which the first break in the V- or γ-p_H curves occurs is numerically equal to $-\log K$ of the acids. R. T.

Interfacial tension and adhesion. F. MICHAUD (J. Chim. phys., 1939, **36**, 23—35).—The subject is discussed theoretically with special reference to interfaces of which one constituent is a solid, in the case of which the best approach is from the conception of adhesion. An expression giving adhesion in terms of adsorption data is deduced. The work of adhesion between H_2O and glass is calc. to be 5200 ergs per sq. cm.   F. L. U.

Capillary systems. XXII₃. Disturbance of neutrality at membranes traversed by a current. E. MANEGOLD and K. KALAUCH (Kolloid-Z., 1939, **86**, 313—339).—Published work is reviewed and discussed.   F. L. U.

Movement of water from concentrated to dilute solutions through liquid membranes. H. M. CASSEL and G. D. MILES (Science, 1939, **89**, 58; cf. A., 1939, I, 140, 196).—A criticism (cf. A., 1938, III, 756).   L. S. T.

Simple analytical derivatives of the expressions for the b.p., the f.p., and the osmotic pressure of an ideal solution and of the variation of latent heat with temperature. K. S. G. DOSS (J. Univ. Bombay, 1938, **7**, 89—93).—Mathematical.   W. R. A.

Determination of particle number of aëro-colloid systems with the slit ultramicroscope and the process of aggregation in aërosols. K. E. STUMPF (Kolloid-Z., 1939, **86**, 339—361).—Want of accuracy in the results hitherto given by the slit ultramicroscope are traced to errors in determining the dimensions of the illuminated space and to too great difference between the depth illuminated and the depth of focus of the microscope. When these sources of error are absent the particle no. determined with the slit ultramicroscope agrees with that calc. from the rate of fall. Measurement of the rate of coagulation of a Fe_2O_3 smoke gave for the coagulation const. the same val. as that obtained by Cawood and Whytlaw-Gray for a similar smoke using a mechanically defined counting space (A., 1936, 1199).   F. L. U.

Influence of the vapours of some organic compounds on the rate of coagulation of aërosols. L. V. RADUSCHKEVITSCH and O. K. TSCHUGUNOVA (J. Phys. Chem. Russ., 1938, **12**, 34—41).—The rate of coagulation of NH_4Cl smoke is not affected by saturated vapours of MeOH, EtOH, and oleic acid. The vol. per particle (σ) increases with time t linearly, $\sigma = \sigma_0 + k_0 t$. In saturated vapour of PhOH $k = 0.77k_0$. The decrease of k_0 may be due to a lowering of the adhesion or to capillary condensation.   J. J. B.

Penetration of light through dense fog. K. UCHIYAMA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 1—8).—No difference is observed in the penetration, measured spectrophotometrically, through fogs of H_2O, dil. HCl, or sea-water. Bluish light penetrates natural fog better than reddish light, although if the size of the droplets is very small, as in a haze or mist, this order is reversed.   D. F. R.

Maximum distance of distinct visibility through a turbid medium. A. MARCELIN (Compt. rend., 1939, **208**, 889—891).—The nearest distance at which a design can be seen clearly through a gutta-percha suspension is $\propto$ 1/concn., i.e., the visibility depends only on the no. of particles present and is independent of their dilution. The distance of visibility is also approx. $\propto$ the distance between the lines in the design. It is suggested that this behaviour could be applied to the examination of polluted oils.   J. W. S.

Electro-optical effects in colloids. H. MUELLER (Physical Rev., 1939, [ii], **55**, 508).—The results of Krishnan (cf. A., 1938, I, 310) are confirmed and corr. For bentonite sols an unusual change of the Tyndall effect when the incident light is polarised at 45° to the electric field is reported and discussed.   N. M. B.

Mechanism of photochemical reactions with inorganic colloids. Influence of light in different states of circular polarisation. J. C. GHOSH and T. BANERJEE (Kolloid-Z., 1939, **86**, 372—387).—A review of published work.   F. L. U.

Superconducting colloidal mercury. D. SHOENBERG (Nature, 1939, **143**, 434—435).—Investigation of the magnetic properties of various colloidal preps. of Hg provides evidence for the existence of a small penetration depth of a magnetic field into a superconductor, and for a temp.-dependence of this penetration of the kind observed by Appleyard et al. (A., 1939, I, 246). The magnetic moment per unit field per unit vol. of small spherical particles of the colloid is < that of a large sphere, and decreases with rise in temp. towards the transition temp. (4.17° K.). With colloidal Hg in albumin in which the particle size is ~10^{-5} cm., penetration of the field is nearly complete.   L. S. T.

Nature of titanium oxide hydrosols. A. W. THOMAS and W. G. STEWART (Kolloid-Z., 1939, **86**, 279—288).—H_2SO_4, $H_2C_2O_4$, and tartaric, lactic, malic, and gallic acids peptise hydrated TiO_2 to negative sols, whilst HNO_3, HCl, HCO_2H, AcOH, and $EtCO_2H$ give positive sols. The charge on positive sols is reversed by aq. NH_3, KOH, and K citrate, lactate, malate, and tartrate. These observations are explained, as in other similar cases (cf. A., 1936, 27, 287), by the displacement of aquo groups in the cationic complex by the added anions. The explanation is supported by p_H and conductivity measurements.   F. L. U.

Viscosity of arsenic sulphide sols and Einstein's formula. A. BOUTARIC and (MLLE.) S. THÉVENET (Compt. rend., 1939, **208**, 746—748).—Variations of Einstein's const. $k = (\eta - \eta_0)d/\eta_0 c$ are studied. k remains approx. const. on dilution of a sol with H_2O, but shows large variations with the nature of the sol and its mode of prep. The changes in an As_2S_3 sol on keeping (cf. A., 1938, I, 28) correspond with a steady decrease in k, which ultimately approaches Einstein's theoretical val. (2.5). The total vol. of the As_2S_3 particles decreases on keeping, and the dissymmetry of the particles is reduced.   A. J. E. W.

Diamagnetism and colloidal electrolytes. M. B. NEVGI (J. Univ. Bombay, 1938, **7**, 74—81).—The types of colloidal electrolytes which are sensible to dilution but form ions which can be dialysed have been

investigated magnetically in the solid phase by the modified Gouy method. The following acids and their Na and K salts have been studied : AcOH, EtCO$_2$H, PrCO$_2$H, palmitic, stearic, oleic, and myristic. The salts of the lower acids give susceptibilities χ in agreement with theoretical vals., but the χ of the salts of the higher acids are $<$ the theoretical vals., indicating a difference in constitution between the salts of the lower and higher acids, in agreement with the fact that alkali salts of the lower acids are strong electrolytes whilst those of the higher acids show anomalies. These differences are probably due to the formation of micelles of large particles of colloidal dimensions by salts of the higher acids.
W. R. A.

Constitution of solutions of the alkali salts of long-chain fatty acids. P. EKWALL (Finska Kem. Medd., 1939, 48, 8—22).—A review.   M. H. M. A.

Sulphonates. III. Solubilities, micelle formation, and hydrates of the sodium salts of the higher alkyl sulphonates. H. V. TARTAR and K. A. WRIGHT. IV. Densities and viscosities of sodium dodecylsulphonate solutions in relation to micelle formation. K. A. WRIGHT and H. V. TARTAR. V. Electrical conductance of sodium decyl-, dodecyl-, and hexadecyl-sulphonate solutions at 40°, 60°, and 80°. Micelle formation. K. A. WRIGHT, A. D. ABBOTT, V. SIVERTZ, and H. V. TARTAR (J. Amer. Chem. Soc., 1939, 61, 539—544, 544—549, 549—554; cf. A., 1938, I, 229).—III. Solubility–temp. curves for Na decyl-, dodecyl-, tetradecyl-, hexadecyl-, and octadecyl-sulphonates are linear for the lower temp. range, but for each salt there is a crit. concn. above which solubility increases rapidly with rise of temp. An interpretation in terms of ionic micelles is put forward. The salts form hydrates containing 3·5 H$_2$O.

IV. Data for d and η at 40—70° are recorded. The equilibrium between the ionic micelle and the Na and alkylsulphonate ions is discussed.

V. The conductance–concn. curves consist of two straight lines intersecting at a crit. concn. Addition of NaCl to Na dodecylsulphonate solutions lowers the crit. concn. The phenomena are interpreted in terms of the ionic micelle theory.   E. S. H.

Saponification in colloidal systems.—See B., 1939, 401.

Plant colloids. XLVI. Ageing of starch solutions considered from the colloid-chemical, enzymic, and X-radiographical point of view. M. SAMEC and J. R. KATZ [with Z. ČANIČ and R. KLEMEN] (Kolloid-Beih., 1939, 49, 455—470).—Data for the variation with time of turbidity, coagulation, η, conductivity, resistance to malt extract, and X-ray spectrum for seven kinds of starch and starch products are recorded and discussed.   F. L. U.

Constitution of crystallised part of cellulose.— See B., 1939, 361.

Hydrolysis and oxidation of cellulose in a homogeneous medium.—See B., 1939, 362.

Dissolution of chemically modified cotton cellulose in alkaline solutions.—See B., 1939, 362.

Osmotic pressure and size of aggregates in cellulose ester solutions. S. A. GLIKMAN (J. Phys. Chem. Russ., 1938, 12, 81—92; cf. A., 1939, I, 77).—The osmotic pressure Π of cellulose nitrate in COMe$_2$ and of cellulose benzoate in EtOH + C$_6$H$_6$ was measured below 1·5% of ester; a cellulose membrane was used. For two solutions Π was independent of concn. below 0·8%; for these solutions η increased linearly with concn., whilst it increased more rapidly for other solutions. The mol. wts. of the fractions are calc.   J. J. B.

Refractive index of cellulose acetate solutions. H. LAOHS and W. MAŃSKI (Rocz. Chem., 1938, 18, 660—667).—The sp. n of cellulose acetate in CHCl$_3$ is $\propto 1/\eta$ of the solutions. The differences found between different samples are $>$ would follow from mol. wt. differences, and are ascribed to varying contents of impurities of a high sp. n.   R. T.

Properties of solutions of cellulose esters. V. Influence of the form of the molecules on the integral heat of dissolution. Z. ROGOVIN and V. IVANOVA (J. Gen. Chem. Russ., 1938, 8, 991—996).— The integral heat of dissolution in COMe$_2$ of cellulose nitrate pptd. from 12% is $<$ from 0·25% solutions; the difference is ascribed to the micellar aggregates being larger in the former than in the latter case.
R. T.

Citrates and the viscosity of pectin solutions. H. P. KORTSCHAK (J. Amer. Chem. Soc., 1939, 61, 681—683).—The η of pectin solutions containing citrates reaches a max. at low citrate concn. and a min. at higher citrate concn. The max. is displaced towards higher citrate concn. by increased pectin concn. or by decreased acidity. Min. η occurs at equal pectin concn. and citric acid concn.
E. S. H.

Colloid-chemical properties of humus. H. ZADMARD (Kolloid-Beih., 1939, 49, 316—364).—The prep. of H- (I), K- (II), and Ca- (III) -humus is described. The dispersing action of bases on (I) increases in the order Ca(OH)$_2$<Ba(OH)$_2$<Sr(OH)$_2$≪ LiOH<NaOH<KOH. The coagulating effect of cations on a sol of (II) follows the order Li<Na< Rb<Cs<Mg≪Ca = Sr = Ba = H. (III) is partly dispersed by alkali chlorides. Data for the adsorption by (I) of alkali and alkaline-earth metal hydroxides, the latter of which are the more strongly adsorbed, are presented. Cl′, NO$_3$′, SO$_4$″, and HPO$_4$″ are not appreciably adsorbed. Electrometric titration of (I) with bases shows that more M(OH)$_2$ than MOH is required to attain the same p_H val. The cation exchange capacity of (II) increases linearly with the radius of the exchanging ion, but this relation is not found with (III). In both (II) and (III) exchange occurs more readily between ions of the same valency.
F. L. U.

Physicochemical characterisation of proteins and protein complexes. W. A. L. DEKKER (Chem. Weekblad, 1939, 36, 198—205).—A review of the electrical properties, solubility, and general structure of protein colloids.   S. C.

Dispersion of protein in aqueous formaldehyde solutions. A. K. SMITH, H. J. MAX, and P. HANDLER (J. Physical Chem., 1939, 43, 347—357).—The

amount of protein dispersion when CH_2O is added to the protein followed by acid or base is < when the acid or base is added to the protein followed by CH_2O. With the latter method, addition of CH_2O causes a displacement of the dispersion curves towards lower p_H vals., and on the alkaline side of the isoelectric point tends to increase the amount of N dispersed. In the latter method it is considered that the protein is dispersed at the time of CH_2O addition and the protein–CH_2O reaction proceeds without pptn., whereas in the former method the protein–CH_2O reaction occurs first and, since this reaction involves the combination of CH_2O with NH_2-groups, results in lower H_2O absorption. Measurements were made at various p_H vals. with soya-bean oil-free meal, purified soya-bean and commercial alpha proteins, self-soured and rennet caseins, and zein. C. R. H.

Coagulating action of alcohols on protein solutions and the Traube rule. S. S. VASSILIEV (Acta Physicochim. U.R.S.S., 1938, **9**, 942—962).— The coagulating action of various alcohols on solutions of ovalbumin (I) has been investigated, using MeOH as a standard of comparison. The coagulating effect increases with increase in mol. wt. of the alcohol, thus following Traube's rule. Kruyt and Jong's theory of protein coagulation is adversely criticised as a general theory, although it may be valid under certain conditions. The first stage in coagulation is adsorption of alcohol on the surface of the protein micelle; the second stage is concerned with changes in the micellar structure, which are irreversible in the ease of (I). C. R. H.

Dielectric behaviour of solutions of the protein zein. M. A. ELLIOTT and J. W. WILLIAMS (J. Amer. Chem. Soc., 1939, **61**, 718—725).—Resonance apparatus for precision dielectric const. measurements with conducting solutions in the frequency range 1·5—40 megacycles is described. Dielectric const. data for dil. solutions of zein in aq. EtOH, in the frequency range 25,000—30 × 10^6 cycles, can be accounted for quantitatively by theoretical equations if the mols. are treated as ellipsoids of revolution. The derived mol. wt. is 38,000 and the ratio of minor to major axis of the zein mol. 1 : 7. The data afford no evidence of a temp. dissociation of zein mols. in solution between 0° and 50°. E. S. H.

Conductivity of gelatin in acid solution. W. K. LEWIS and G. BROUGHTON (J. Physical Chem., 1939, **43**, 359—362).—The H˙ activity and conductivity of HCl solutions containing 1% of gelatin (I) have been determined. From p_H 4·6 the conductivity of (I) increases with decreasing p_H to a max. val. at p_H 3·3, but, contrary to cataphoretic data, the conductivity continues to decrease as the p_H is further reduced. C. R. H.

Constitution of collagen.—See B., 1939, 410.

Surface solvation in disperse systems. V. Influence of surface-active substances on the structure of rubber sols. V. MARGARITOV. **VI. Effect of surface-active substances on the equilibrium of fractions of sodium divinyl polymeride.** V. MARGARITOV and L. SEREBRIANIKOVA

(Acta Physicochim. U.R.S.S., 1938, **9**, 917—926, 963—964).—V. The structure-forming action of fatty acids, amines, and azo-dyes on natural rubber sols (I) in C_6H_{14} and on Na divinyl polymeride (II) has been investigated. Oleic acid (III) strongly influences the structure of (I). At room temp. the yield val., θ, increases with increase in the concn. of (III). At lower temp. the internal structure develops intensively and (III) begins to act as a peptising agent. Of the NH_2-compounds and dyes examined, $C_7H_{15}\cdot NH_2$ and the azo-dye " para-red " most strongly influence the structure of PhMe solutions of (II), and azo-dyes accelerate the disintegration of the micellar structure during heating. The colloidal state of highly polymeric compounds is mainly determined by the temp. of the surrounding medium. Dogadkin's theory that the fall in η of (I) on heating is due to the dissociation of its mol. chains under the action of O_2 is adversely criticised.

VI. Preliminary data on the effect of NH_2- and azo-compounds on θ for various fractions of (II) are recorded. C. R. H.

Preparation and properties of transparent inorganic gels. M. PRASAD and D. M. DESAI (J. Univ. Bombay, 1938, **7**, 132—156).—The times of setting t and p_H of various transparent gels (arsenates of Th, Sn···· , Mn, Zn; phosphates of Th, Sn···· , Ce; and Th molybdate) containing different amounts of the two constituents of the gel-forming mixtures have been measured at 30°. The limits of composition within which a transparent gel is formed, and beyond which a ppt. is obtained or the gel does not set, are given. Increase in concn. of the constituent containing the gel cation (I) generally increases t, whilst increase in the constituent containing the gel anion (II) generally decreases t. This decrease may be due to an increase in the gelling substance and the consequent decrease in the amount of the peptising (metal) ions, and in the coagulating electrolyte. Increase in (I) either has no effect on the p_H of the gel-forming mixtures or decreases it, whilst increase in (II) generally decreases it. The n of all the gel-forming mixtures increases with increase in concn. of (I) and (II). W. R. A.

Causes of gel formation by organic salts in methyl alcohol solution. H. HENSTOCK (J. Amer. Chem. Soc., 1939, **61**, 670—673).—The adsorption of the Na, K, and Ca salts of simple org. acids by kieselguhr, kaolin, animal C, and lampblack has been measured. Adsorption is greatest for each adsorbent with those salts which do not form gels on addition of org. liquids. The cause of gel formation lies in the degree of mol. aggregation of the salt in solution and the large at. vol. of the metals concerned. E. S. H.

Influence of surface-active substances on structure formation in gelatin sols. K. F. SHIGATSCH, P. A. REHBINDER, and G. G. EDELMAN (Compt. rend. Acad. Sci. U.R.S.S.,1938, **21**, 392—395). —Measurements have been made of the surface tension of aq. solutions of agar-agar, starch, gelatin, albumin, sol. tragacanth, and saponin and of the η of gelatin sols in the presence of EtOH, PrOH, BuOH, or $CO(NH_2)_2$. The results show that surface-active substances exhibit little tendency to promote gel

formation and tend to inhibit structure formation in other sols. This action is due to the surface-active substance producing decreased solvation by the union of its polar groups with those of the hydrophilic micelle. D. F. R.

Mechanism of electro-osmosis in gelatin gels. J. SWYNGEDAUW (Compt. rend. Soc. Biol., 1938, **129**, 961—964).—The mobilities of $K^{\cdot}$, $Na^{\cdot}$, and $Li^{\cdot}$ in a gelatin gel are slightly $<$ the calc. vals. for dil. solutions, but are closer to calc. vals. than those obtained by direct methods. The no. of H_2O mols. transported by the alkaline ions varies with the ion and is greater in more dil. solutions. H. G. R.

Rôle of ionic hydration in electro-osmosis of isoelectric gelatin gels. J. SWYNGEDAUW (Compt. rend. Soc. Biol., 1938, **129**, 964—967).—Ionic hydration is slightly less in isoelectric than in alkaline gels, transport by hydration being the only mechanism in the former. H. G. R.

Influence of non-electrolytes on water content of muscles and on swelling of gelatin.—See A., 1939, III, 420.

Behaviour of microscopic bodies consisting of biocolloid systems and suspended in an aqueous medium. IV. Vacuolation of complex coacervate drops at constant temperature. Formation of foam structures and of thin-walled drops with large central vacuole. V. Gelatinised hollow spheres. Temporary invagination to gastrula-like bodies by mechanical or osmotic removal of water from central cavity. H. G. B. DE JONG and O. BANK (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 274—284, 285—288; cf. A., 1938, I, 457).—IV. Optimal coacervation occurs during reversal of charge when HCl is added to isoelectric gelatin + Na arabate. Uncharged or positively charged coacervate drops obtained after mixing the " molten " coacervate with H_2O at 36° contain several small vacuoles which disappear in time, leaving homogeneous coacervate drops. Negatively charged coacervate drops show first a peripheral formation of foam vacuoles, the whole drop changing to a complex of foam vacuoles; the foam lamellæ then bursts, to give drops with a smaller no. of foam vacuoles and later liquid hollow spheres. A theory of vacuolation phenomena and the biological significance of the process are discussed.

V. Mechanical or osmotic removal of H_2O from the central cavity of gelatinised hollow spheres obtained by cooling the liquid hollow spheres leads to invagination, reversal to the original form occurring after removal of pressure. The permeability of the globular gel skin increases in the order : sucrose $<$ glycerol $<$ EtOH. Invagination of shorter duration occurs with electrolytes. F. H.

Physico-chemical properties of deoxycholic acid. J. C. VLÈS (Compt. rend., 1939, **208**, 950—952).—Deoxycholic acid forms at p_H 7·5 a clear gel which becomes cloudy with decreasing p_H and ppts. at p_H 6·5. At p_H 13·5 a limpid and an oily phase are formed. The changes are reversible. The isoelectric point is at p_H 8·5. The ultra-violet and infra-red spectra are described. J. L. D.

Principles of the genetic development of materials. IX. Chemical importance of somatoids. V. KOHLSCHÜTTER (Helv. Chim. Acta, 1939, **22**, 277—282).—Present information on somatoids and the mechanism of their formation is summarised. The somatoid is regarded as a definite form of physicochemical unit in the structure of matter. J. W. S.

Co-existence of reversible and irreversible aggregates in thixotropic gels of hydrophobic particles. W. HELLER and E. VASSAY (Compt. rend., 1939, **208**, 812—814).—The co-existence of reversible and irreversible aggregates has been demonstrated by following the absorption of light by a Fe_2O_3 sol after the addition of aq. NaCl of various concns. W. R. A.

Bursting of glass tubes by thixotropic pastes. G. W. COWDREY and M. L. SMITH (Nature, 1939, **143**, 435—436).—Shaking a thixotropic paste in closed, stout-walled test-tubes occasionally results in an outward bursting of the tube, with the bulk of the paste ejected violently as a single lump. The type of fracture with different tubes is always the same. An explanation is suggested. L. S. T.

Coagulation of silver iodide hydrosol. A. BASIŃSKI (Rocz. Chem., 1938, **18**, 336—349).—Measurements of the activities of ions at concns. causing flocculation of AgI hydrosols of various concns., at different temp., and in presence of different concns. of EtOH, do not confirm Ostwald's hypothesis (A., 1937, 614 and preceding abstracts), except as a special case. R. T.

Sensitisation of a silver iodide sol by hydrophilic colloids. J. DEVEUX (J. Chim. phys., 1939, **36**, 5—18).—Na arabate (I), konyaku (II), sol. starch (III), and flocgel (prep. of potato starch) (IV) all exert a protective action on AgI sol at concn. >5—$25 \times 10^{-4}\%$. They also exert a sensitising action, measured by the flocculation val. for KNO_3, which for (I) is very slight, for (II) slightly greater, and for (III) and (IV) is marked and persists through a wide concn. range. Measurements of electrophoretic velocity show that the sensitising action does not depend on a reduction of the ζ-potential. A mechanism is suggested. F. L. U.

Hydrous lanthanum hydroxide sols. T. MOELLER and F. C. KRAUSKOPF (J. Physical Chem., 1939, **43**, 363—378).—La(OH)$_3$ sols are stabilised by $La^{\cdots}$, the stability being a function of $[La^{\cdots}]$. With decrease in p_H through HCl addition, there is a general increase in flocculation val. on the addition of electrolytes except for LaCl$_3$, KH$_2$PO$_4$, and K$_4$Fe(CN)$_6$. This increase is steady except between p_H 6·67 and 6·34, where there is a sudden increase in stability. The increased stability on adding HCl is due to the formation of $La^{\cdots}$ in the sol. The nature of the cation appears to have little effect on the flocculating val. of electrolytes. A highly purified sol follows the Burton–Bishop rule for all added electrolytes except KCl and KBr. With the exception of K$_4$Fe(CN)$_6$, all electrolytes are slightly more effective in presence of EtOH, but neither EtOH nor COMe$_2$ alone can flocculate the sols. The d of La(OH)$_3$ sols varies linearly with sol concn. The sols exhibit a well-defined

Tyndall effect. Undialysed sols may be boiled or frozen without flocculation. The coagulum from a boiled sol is cryst. and finely divided, indicating the ageing effects of heating.   C. R. H.

Ionic interchange in sulphur sols. IV. Action of multivalent metallic ions. T. R. BOLAM and A. B. CURRIE (J.C.S., 1939, 296—300; cf. A., 1934, 841).—The amount of exchange of cations with H˙, derived from the polythionic acid present in the micelles of S sols, is the same for LiCl, BaCl$_2$, and NdCl$_3$ at the respective threshold coagulating concns. The relation of the interchange to the coagulation process is discussed.   E. S. H.

Influence of non-electrolytes on velocity of coagulation of colloidal antimony and arsenious sulphides. K. JABŁCZYŃSKI, S. OBRĘBSKI, and O. PRZYGODA (Rocz. Chem., 1938, 18, 557—562).—Flocculation of Sb$_2$S$_3$ sols by KCl is accelerated by MeOH, EtOH, PrOH, and (CH$_2$·OH)$_2$, in the descending order given, and is inhibited by glycerol. Flocculation of As$_2$S$_3$ sol is prevented by EtOH and PrOH, which dissolve the ppt., and by dextrin, whilst MeOH, (CH$_2$·OH)$_2$, glycerol, and mannitol accelerate flocculation in the descending order given.   R. T.

Change of turbidity during flocculation of manganese dioxide sol by mercuric sulphate solution. A. PURUSHOTAM (Kolloid-Z., 1939, 86, 361—365).—Whilst the turbidity of a MnO$_2$ sol is increased during slow coagulation by NaCl, it decreases when HgSO$_4$ is the coagulant. In both cases, however, the coagulation-time curves are discontinuous.   F. L. U.

Hydrosols and electrolytic ions. P. G. NUTTING (Science, 1939, 89, 131).—When a clay or soil is brought to equilibrium with dil. acid, filtered, and the solution electrodialysed, the SiO$_2$ is carried equally in both directions. Other ions present are usually found in unequal amounts in anode and cathode liquids, but the SiO$_2$ is strictly amphoteric. Electrodialysis of a solution not in equilibrium with clay or soil shows an unequal partition of the SiO$_2$; an acid clay shows an excess of SiO$_2$ transported as cations, and a slightly alkaline soil, a slight excess of SiO$_2$ as anions. The SiO$_2$ is equally divided when a pure SiO$_2$ gel is electrodialysed, whilst an alkaline solution of a neutral clay gives four times as much anion as cation SiO$_2$. In an equilibrium solution charged ions appear to be absorbed in equal nos. on the SiO$_2$.   L. S. T.

Statistical theory of condensation phenomena. J. FRENKEL (J. Chem. Physics, 1939, 7, 200—201).—Essentially the same results as those given by the mathematical theory of condensation phenomena of Mayer et al. and others (cf. A., 1938, I, 185, 352, 445) can be obtained in an elementary way by using the statistical theory of chemical equilibrium in a gas mixture. The theory further accounts for over-saturation phenomena, and can be applied to the phenomena of polymerisation.   W. R. A.

Mechanism of additions to double bonds. VII. Chemical equilibrium in solution and in the gaseous state. G. A. BENFORD and A. WASSERMANN. **VIII. Equilibrium of gaseous associations.** B. S. KHAMBATA and A. WASSERMANN

(J.C.S., 1939, 367—371, 371—375).—VII. Since both equilibrium consts. and solubilities can be expressed in the form $Ae^{-Q/RT}$ the consts. A and Q characterising equilibrium in solution and in the gas phase may be compared by using solubility data and the van 't Hoff expression involving equilibrium consts. and solubilities. The calculation has been performed for the equilibria C$_2$H$_4$ + H$_2$ $\rightleftharpoons$ C$_2$H$_6$ and 2(cyclopentadiene) $\rightleftharpoons$ (endodicyclopentadiene). Q for both associations, and A for the first, are not much affected by the solvent, but A for the second in paraffin solution is approx. 20 times that in the gas phase. Data on the solubilities of cyclo- (I) and dicyclopentadiene (II) in paraffin are recorded.

VIII. The rate of association of (I) in paraffin at temp. between $-1°$ and $172°$ has been determined. The reaction is bimol. and obeys the Arrhenius equation. From the results, combined with those for the rate of the reverse reaction (cf. A., 1939, I, 269) and with solubility data (see above), the non-exponential factor of the equilibrium const. in the gas phase is obtained, and from this the ratio V_2/V_1^2 [where V_2 and V_1 are the vibrational partition functions of (II) and of (I) respectively] is calc., the rotational partition functions being calc. from vals. for the moments of inertia obtained from models. V_2/V_1^2 is $\sim$500 at 80°.   F. J. G.

Singular point in the mass-action law diagram for a compound AB$_2$, formed from one atom of the first component and an even number of atoms of the second component. N. I. STEPANOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 293—306; cf. A., 1937, I, 568).—Each val. of r is represented by an isolated point.   L. J. J.

Molecular association in mixtures of acetic acid and acetone. P. KOTESWARAM (Current Sci., 1939, 8, 70—71).—The max. of the C:O Raman band of pure AcOH is shifted to higher frequencies by dilution with COMe$_2$. The weak component of the C–C frequency of AcOH becomes of comparable intensity to the C–C frequency and both are shifted to smaller νν on dilution with COMe$_2$. The C:O frequency of COMe$_2$ is shifted to a lower and the C–C frequency to a higher val. A new displacement of $\sim$1760 cm.$^{-1}$ appears and has greatest intensity for a 1 : 1 vol. ratio. The shifts are explained by complex formation through a H-bond between the OH of AcOH and the C:O of COMe$_2$. The new displacement is attributed to the unco-ordinated C:O of the complex Ac·OH---O:CMe$_2$.   W. R. A.

Kinetics of complex formation in non-aqueous solutions in connexion with electrical conductivity. II. E. J. GORENBEIN (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 5, 451—456).—The conductivity of a solution of SbBr$_3$,AlBr$_3$ complex in C$_6$H$_6$ changes considerably with time. This is attributed to reaction between the complex and C$_6$H$_6$ to form the further complex SbCl$_3$,AlCl$_3$,C$_6$H$_6$. This reaction is unimol. with a mean velocity coeff. $52\cdot4 \times 10^{-4}$.   J. W. S.

Viscosity and fusibility of binary systems containing antimony tribromide and aniline (or its derivatives). N. S. KURNAKOV, N. K. VOSKRESENSKAJA, and G. D. GUROVITSCH (Bull. Acad. Sci.

U.R.S.S., 1938, Sér. Chim., 391—401).—Viscosity isotherms show max. indicating formation of equimol. compounds of $SbBr_3$ with NH_2Ph, $p\text{-}C_6H_4Br\cdot NH_2$, and probably $NHPhMe$. No compound is formed with $p\text{-}NO_2\cdot C_6H_4\cdot NH_2$. The fusion curves are in agreement.   L. J. J.

Viscosimetry of binary liquid systems containing bromine or water and organic substances. N. S. KURNAKOV, N. K. VOSKRESENSKAJA, N. GOLTZMAN, and M. SCHUVALOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 379—390).—Viscosity isotherms for the $Br\text{-}CHMe\text{:}CMe_2$ and $Br\text{-}C_2H_2Br_2$ systems show max. corresponding with formation of $1:1$ compounds; $CPh\text{:}CH$ forms a di- and a tetra-bromide. Pr^a_2O, $Br\cdot[CH_2]_3\cdot OEt$, $CH_2Ph\cdot OMe$, and $(CH_2Ph)_2O$ form tribromides. Interaction of H_2O with $MeCHO$ and γ-valerolactone is indicated by contraction and max. on the viscosity isotherms.   L. J. J.

Selective solvation of lithium chloride in mixed solvents. [I.] Experimental. Y. KOBAYASHI, K. TAKA, and M. MIURA. **[II.] Theoretical.** Y. KOBAYASHI (J. Sci. Hiroshima Univ., 1939, A, 9, 33—50, 51—66).—I. Densities of the following solutions have been determined at 25°: (1) $CO(NH_2)_2$-H_2O mixtures, (2) $0\cdot5M$-LiCl in (1), (3) $NH_2\cdot CO_2Et$-H_2O mixtures, (4) $0\cdot5M$-LiCl in (3). From the results the apparent mol. vols. of $CO(NH_2)_2$ in (1), $NH_2\cdot CO_2Et$ in (3), and LiCl in (2) and (4) have been calc. and recorded graphically.

II. The above results and similar measurements by Butler and Lees (cf. A., 1931, 680) on the system $EtOH$-H_2O-LiCl are discussed in relation to the macroscopic compressibilities and dielectric consts. of the mixed solvents. It is inferred that the Li^+ ion in $EtOH$-H_2O mixtures is surrounded by a " co-ordination sphere " of H_2O mols. In $CO(NH_2)_2$-H_2O mixtures there is a solvation shell of $CO(NH_2)_2$. In $NH_2\cdot CO_2Et$-H_2O mixtures the first co-ordination sphere of $NH_2\cdot CO_2Et$ is surrounded by a shell of H_2O mols., beyond which there is a short region of decreasing $[H_2O]$.   J. A. K.

Cryoscopy of molybdic acid in aqueous solution. E. DARMOIS, Y. DOUCET, and (MLLE.) M. MURGIER (Compt. rend., 1939, 208, 750—751).—Extrapolation of the cryoscopic const. to zero concn. shows that the solutions (cf. A., 1939, I, 274, for method of prep.) contain the acid $H_2Mo_4O_{13}$, dissociating to $2H^{\cdot}$ and Mo_4O_{13}''. Activity calculations show that this acid is moderately strong.   A. J. E. W.

Constitution of molybdic acid in dilute aqueous solution. (MME.) Z. SOUBAREW-CHATELAIN (Compt. rend., 1939, 208, 584—586).—The variation of p_H during titration of aq. MoO_3,H_2O or $MoO_3,2H_2O$ with NaOH shows that the solutions contain the strong acid $H[HMo_2O_7]$. $[HMo_2O_7]'$ is weakly acidic; K for the equilibrium $[HMo_2O_7]' \rightleftharpoons [Mo_2O_7]'' + H^{\cdot}$ being $(0\cdot95\pm0\cdot05) \times 10^{-5}$ for p_H $4\cdot6$—$5\cdot1$. The data are incompatible with formation of tetramolybdates.   A. J. E. W.

Titration curves in the system $Cd^{++} + Rb^+ + Fe(CN)_6\text{----}$. I. TANANAEV and E. S. DSHAPARIDZE (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 539—545).—The equivalence point corresponding with $Cd_2Fe(CN)_6$ in dil. solution is displaced by addition

of $> 4KCl : 15Cd$, owing to formation of $K_2CdFe(CN)_6$. The effect of RbCl is more pronounced, and $Rb_2CdFe(CN)_6$ is pptd. from very dil. solutions containing $Rb : K = 1 : 2$.   L. J. J.

More rational method of stating hydrogen-ion concentration. L. M. BOOTH (Paper Trade J., 1939, 108, TAPPI Sect., 97—101).—The use of the Wherry non-logarithmic system of recording $[H^{\cdot}]$ (Amer. J. Pharm., 1927, 99, 342) is advocated, as being simpler than the p_H method.   H. A. H.

Dielectric potential of certain esters. B. ZAPIÓR (Rocz. Chem., 1938, 18, 888—891).—The pK of β-eucaine, amylocaine, homatropine, and benzocaine, as derived from the point of inflexion of the dielectric potential–p_H curves, are $5\cdot54$, $6\cdot6$, $4\cdot75$, and $11\cdot3$, respectively.   R. T.

Ionisation of magnesium citrate. R. NORDBÖ (Skand. Arch. Physiol., 1938, 80, 341—347).—The dissociation const. was determined by measuring the p_H of a solution containing $Mg^{\cdot\cdot}$ and citrate ions. The Mg was determined colorimetrically.   A. S.

Anomalous effect of magnesium chloride on the dissociation of weak acids. I. GREENWALD (J. Physical Chem., 1939, 43, 379—382).—The anomalous effect of $Mg^{\cdot\cdot}$ on the dissociation of $H_2C_2O_4$, glycine, and malonic and aspartic acids is explainable on assuming the formation of slightly dissociated complexes.   C. R. H.

Quinhydrones. V. L. BRÜLL and F. GRIFFI (Gazetta, 1939, 69, 44—56).—Extinction coeffs. of quinhydrone in H_2O-EtOH mixtures have been measured for the range 4000—7000 a. From the spectrophotometric data the degree of dissociation of the quinhydrone is calc. and found to increase with dilution and with increasing EtOH content. The absorption curve of benzoquinone in EtOH has also been measured.   O. J. W.

Value of the second dissociation exponent of phosphoric acid and the effect of various factors. I. Dissociation constant of phosphoric acid. II. Determination of the dissociation constant of a weak acid. K. SHIMA (J. Biochem. Japan, 1939, 29, 121—145, 147—153).—I. Vals. of p_H (quinhydrone electrode) of equimol. mixtures of H_2PO_4' and HPO_4'' give pK $7\cdot04$, $7\cdot02$, and $7\cdot01$ at 18°, 25°, and 37°, respectively. Variations in pK' ($K =$ real, K' apparent dissociation const.) for different ratios of H_2PO_4' to HPO_4'' are described. Addition of neutral salts (NaCl, KCl, $MgCl_2$, $MgSO_4$) diminishes pK' to an extent $\propto$ ionic strength; the ions give the order $K^{\cdot} < Na^{\cdot} < Mg^{\cdot\cdot}$ and $PO_4''' < SO_4'' < Cl'$. Titration data indicate that pK' in urine is $6\cdot62$ at 18° and $6\cdot4$—$6\cdot6$ at 37°.

II. pK' is found by taking arbitrary points on the titration curve and finding the concns., a and b, of HCl or NaOH required to shift the p_H down or up, respectively, by $1\cdot0$; then $pK' = p_H - \log (10a - b)/(10b - a)$. For H_3PO_4 the method gives $pK'_2 = 6\cdot860$ at 18°.   F. O. H.

Dissociation constants of organic acids. XX. Thermodynamic primary dissociation constants of some alkylglutaric acids. G. H. JEFFERY and

A. I. VOGEL (J.C.S., 1939, 446—452).—From measurements of Λ over the range 0·0001—0·01N. at 25° for a no. of β-alkyl- and ββ-dialkyl-glutaric acids and their Na salts, the following thermodynamic primary dissociation consts. have been evaluated for the acids with substituents indicated : Me, 0·5815; Et, 0·5189; Pr$^\alpha$, 0·4910; Me$_2$, 1·903; MeEt, 2·335; Et$_2$, 3·286; MePr$^\alpha$, 2·367; EtPr$^\alpha$, 3·086.   F. J. G.

Electrostatic influence of substituents on the dissociation constants of organic acids. III. F. H. WESTHEIMER and M. W. SHOOKHOFF (J. Amer. Chem. Soc., 1939, **61**, 555—560).—Published work is reviewed in the light of the mathematical formulation of Kirkwood and Westheimer (A., 1938, I, 574).   E. S. H.

Determination of the ionisation constant of aci-nitroethane. S. H. MARON and T. SHEDLOVSKY (J. Amer. Chem. Soc., 1939, **61**, 753—754).—Electrometric measurements give $K = (4·09 \pm 0·10) \times 10^{-5}$ at 23°.   E. S. H.

Dissociation constants of m-halogenated phenols and their mononitro-derivatives. H. H. HODGSON and R. SMITH (J.C.S., 1939, 263—264).—Vals. obtained for m-halogenophenols in H_2O and in 30% aq. EtOH confirm published data (A., 1936, 159). Dissociation consts. of 3-fluoro-2-, -4-, and -6-nitro-, 3-chloro- and 3-bromo-2- and -4-nitro-phenol in 30% aq. EtOH have been determined to ascertain the combined effect of NO_2 and halogen. Regularities in the series are discussed.   E. S. H.

Second dissociation constant of barium hydroxide. C. W. DAVIES (J.C.S., 1939, 349).—The val. calc. from published data is $K = 0·23$.   E. S. H.

Connexion between dielectric potential and dissociation constant of certain organic bases. A. WAKSMUNDZKI (Rocz. Chem., 1938, **18**, 865—869).—The dissociation const. of surface-active bases (o- and p-toluidine, NPhMe$_2$, cyclohexylamine) is given by $K = 10^{-14+p}$, where p is the p_H at which inflexion of the dielectric potential-p_H curves is observed, at room temp.   R. T.

Mechanism of the influence of substituents on the reactivity of benzene derivatives. G. SCHWARZENBACH and E. RUDIN (Helv. Chim. Acta, 1939, **22**, 360—376; cf. A., 1934, 1309, 1310).—For m- and p-substituted phenols and thiophenols in which the substituent is such that a resonance state with the OH or SH group is impossible (Cl, Br, I, OMe, Me, OH, NMe$_3$˙) the dissociation consts. of the substituted compounds (K_s) and of the unsubstituted compounds (K) are related by log $(K_s/K)_{\text{phenol}} = \log (K_s/K)_{\text{thiophenol}}$. This is in accord with the view that the change in degree of dissociation is an electrostatic influence, and that inductive effects are almost completely absent. When a resonant state can set in between the groups the rule breaks down, as the C:S group is formed more easily than the C:O group. The resonance effects decrease in the order NO_2 > COMe > CO_2Me. The relation does not hold for o-substituted compounds owing to the presence of sp. influences, particularly inductive effects. Hammett's observations (A., 1937, I, 142; 1938, I, 145)

can be explained on pure electrostatic effects. Me m-, m.p. 148°, and p-thiolbenzoate, m.p. 50°, b.p. 139—140°/11 mm., m-, b.p. 137°/11 mm., and p-thiolacetophenone, b.p. 142°/11 mm., are described.   J. W. S.

B.-p. elevation. II. Sodium chloride 0·05—1·0M. and 60—100°. R. P. SMITH (J. Amer. Chem. Soc., 1939, **61**, 500—503.; cf. A., 1939, I, 221).—B.p. elevations have been determined and the activity coeffs. of the solute calc. The results are compared with those of e.m.f. measurements.   E. S. H.

Equilibrium between liquid and gas phases at high temperatures and pressures.—See B., 1939, 345.

System palladium–hydrogen. A. MICHEL (Bull. Assoc. Tech. Fond., 1938, **12**, 302—304).—Examination of Pd containing varying amounts of adsorbed H by thermal and X-ray analysis, dilatometry, measurements of magnetic susceptibility and mechanical properties show that up to the composition of Pd$_4$H, the H atoms fill in the empty space in the centre of each elementary face-centred cubic cell of Pd atoms, causing very little distortion of the lattice. Above this limit PdH is formed.   R. C. M.

Ebulliometric study of the system formic acid–water. E. JÓZEFOWICZ (Rocz. Chem., 1938, **18**, 577—584).—HCO$_2$H containing 0·007% H_2O prepared by fractional vac. distillation has b.p. 100·502°/1 atm. The H_2O–HCO$_2$H azeotrope has b.p. 107·378°/1 atm., and contains 32·7% H_2O.   R. T.

Application of X-radiography to study of the systems $A_{\text{solid}} = B_{\text{solid}} + C_{\text{gas}}$. S. ŻEROMSKI and W. SZAMBORSKA (Rocz. Chem., 1938, **18**, 924—929).—The X-ray diagrams of $ZnCO_3$ and $CdCO_3$ subjected to thermal dissociation suggest occlusion of, but not combination with, part of the evolved CO_2. Considerable deformation of the space lattice is found for products of low-temp. dissociation.   R. T.

Thermal dissociation of cæsium palladichloride. F. PUCHE (Compt. rend., 1939, **208**, 656—657; cf. A., 1938, I, 253).—Vals. of the dissociation pressure at 241—404° for the reaction $Cs_2PdCl_{6sol.} \rightleftharpoons Cs_2PdCl_{4sol.} + Cl_{2gas} -Q$ are tabulated; $Q = 22·2$ kg.-cal.; $Q/T_n = 0·0328$ (T_n = normal dissociation temp.). Cs_2PdCl_6 is the most stable of the alkali palladichlorides.   A. J. E. W.

Thermal dissociation of nitrates, in the light of the phase rule. M. CENTNERSZWER (Rocz. Chem., 1938, **18**, 419—424).—Dissociation of alkali nitrates proceeds as follows : $2MNO_3 \rightarrow 2MNO_2 \rightarrow M_2O + NO_2 + NO$; the m.p. and dissociation temp. θ rise with increasing at. wt. in the series Li, Na, K, Rb, Cs. In this series, the θ of the nitrites is > that of the nitrates, and of both > their m.p. The same applies to the alkaline-earth nitrates, except that here m.p. is > θ. In both cases, θ depends on both the content of nitrite in the substrate, and the pressure. In the case of $AgNO_3$, θ is < for $AgNO_2$, so that the system consists of $AgNO_3$, Ag, and gaseous products $(2AgNO_3 \rightarrow 2Ag + 2NO_2 + O_2)$, and θ depends only on the pressure. The same applies to Pb(NO$_3$)$_2$,

which dissociates in 3 stages : $Pb(NO_3)_2$ 302° → $2PbO,5Pb(NO_3)_2$ 448° → $3PbO,Pb(NO_3)_2$ 531° →PbO.
R. T.

Dissociation pressure of copper sulphate pentadeuterate and trideuterate. F. SCHACHERL and O. BĚHOUNEK (Coll. Czech. Chem. Comm., 1939, **11**, 57—69).—Tensimetric measurements at 20—60° satisfy the equations $\log_{10} p = 11 \cdot 176 - 3086 \cdot 98/T$ and $\log_{10} p = 10 \cdot 625 - 2956 \cdot 88/T$ for $CuSO_4,5D_2O$ and $CuSO_4,3D_2O$, respectively.
E. S. H.

Dissociation pressure of beryllium sulphate hydrates. A. V. NOVOSELOVA and M. E. LEVINA (J. Gen. Chem. Russ., 1938, **8**, 1143—1152).—Tensimetric data suggest the cryst. hydrates $BeSO_4,2$ and 4, but not $1H_2O$, at 30—50°.
R. T.

Thermal dissociation of zinc carbonate. A. ROSE (Compt. rend., 1939, **208**, 905—906).—$ZnCO_3$ is decomposed completely and continuously when heated in CO_2, the reaction being complete in 110 days at 345°, 260 hr. at 385°, and 15 min. at 495°. The rate of loss of CO_2 decreases as the decomp. proceeds, owing to the formation of a surface layer of ZnO. X-Ray diagrams indicate the absence of mixed crystals of ZnO and $ZnCO_3$ postulated by Centnerszwer (A., 1930, 699).
J. W. S.

Influence of solubility of a metal in its oxide on the chemical stability of the latter. Interpretation of phenomena observed with cadmium oxide. M. DODÉ (J. Chim. phys., 1939, **36**, 36—38).—Data published by Faivre and Michel (A., 1938, I, 501) are shown to support the author's views (ibid., 197) on the influence of solid miscibility on chemical equilibrium.
F. L. U.

Affinity. LXXXVII. Phosphides of copper. H. HARALDSEN (Z. anorg. Chem., 1939, **240**, 337—354).—The system Cu–P has been investigated by means of tensimeter curves and X-rays. Of the various Cu phosphides recorded in the literature only Cu_3P and CuP_2 exist. Cu_3P has ρ_4^{25} 7·147 and CuP_2 has ρ_4^{25} 4·201; the mol. vol. increments for P are respectively 9·7 c.c. (the usual val. for intermetallic compounds) and 11·4 c.c. (= the val. for black P). They are both diamagnetic, χ being $-0 \cdot 15 \times 10^{-6}$ for Cu_3P and $-0 \cdot 28 \times 10^{-6}$ for CuP_2. From the tensimeter curves the heat of formation of CuP_2 from Cu_3P is 52·0 kg.-cal. per g.-mol. of gaseous P_4 at 697°. The dissociation pressure over $CuP_2 + Cu_3P$ is given by $\log p = -11,370/T + 13 \cdot 827$, and becomes = 760 mm. at 765°. Solid solutions with excess P are formed by Cu_3P up to approx. $CuP_{0 \cdot 38}$ and by CuP_2 up to approx. $CuP_{2 \cdot 96}$. Cu_3P is hexagonal, with a 6·942, c 7·098 A., $c/a = 1 \cdot 022$. CuP_2 has a complicated structure, different from that of AgP_2.
F. J. G.

Behaviour of pyridine in binary systems with certain phenols and ketones.—See A., 1939, II, 226.

Behaviour of phenols in presence of certain amines. K. HRYNAKOWSKI and F. ADAMANIS (Rocz. Chem., 1938, **18**, 538—549).—1 : 1 Compounds are formed in the systems NH_2Ac–m-cresol (I), transition point 22·5°, –p-cresol (II), m.p. 22·5°, p-anisidine (III)–(I), transition point 13·2°, –(II), m.p. 56·8°, 1 : 2 compounds in the systems (III)–o-cresol (IV), m.p.

35·7°, benzidine–(IV), m.p. 93·8°, –(I), m.p. 90·0°, and –(II), m.p. 138·5°, and a 2 : 1 compound, m.p. 39·2°, in the system (III)–(IV). Compounds are not found in the systems (IV)–NH_2Ac, –NHPhAc, –(NHPh)$_2$, and –diethylbarbituric acid (V), (I)–NHPhAc and (V), and (II)–NHPhAc, –(NHPh)$_2$, and –(V).
R. T.

Thermal analysis of binary systems containing glyceryl trinitrate. III. J. HACKEL (Rocz. Chem., 1938, **18**, 524—529).—The fusion diagrams do not suggest compound formation in the systems glyceryl trinitrate (I)–$NH_2 \cdot CO \cdot NMe_2$, –$CO(NHMe)_2$, –$NH_2 \cdot CO \cdot NPh_2$, –$NH_2 \cdot CO \cdot NPhEt$, and –NPhMe·CO·NPhEt. (I) gives a 1 : 3 compound, f.p. 93·2°, with $NH_2 \cdot CO \cdot NHMe$, and a 1 : 2 or 1 : 3 compound, transition point 75°, with $CO(NHEt)_2$.
R. T.

Equilibria in the system H_2SO_4–$(NH_4)_2SO_4$–H_2O, at 98·3°. N. V. SCHISCHKIN and E. D. POCHVALENSKI (J. Gen. Chem. Russ., 1938, **8**, 1125—1131).—The solid phases found were $(NH_4)_2SO_4$ (I), $3(NH_4)_2SO_4,H_2SO_4$ (II), and NH_4HSO_4 (III); the invariant point for (I) and (II) is at (I) 54·27, H_2SO_4 20·45, and H_2O 25·28%, and that for (II) and (III) is at (I) 58·53, H_2SO_4 35·9, and H_2O 5·57%. Co-ordination formulæ are advanced for (II) and (III).
R. T.

Double decomposition in the absence of a solvent. XXXVI. Irreversible mutual system of sodium and magnesium chlorides and sulphates. E. I. SPERANSKAJA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 463—487).—$NaCl$–$MgSO_4$ represents a simple eutectic system. Two NaCl–$MgCl_2$ compounds and a compound $3MgSO_4,Na_2SO_4$ can be formed, so that the crystallisation surface consists of seven cryst. fields convergent in three triple transition points and two triple eutectic points. Space diagrams are given for the Na–Mg and K–Mg systems.
L. J. J.

Limits of expansion of the fields of crystallisation of the system $MgSO_4$–$NaCl$–H_2O, under conditions of isothermic evaporation at 25°. E. J. LEVINA (J. Appl. Chem. Russ., 1938, **11**, 1266—1294).—The limits of expansion of the fields of crystallisation of NaCl, thenardite, epsomite, and $Na_2SO_4,10H_2O$ are defined as being the lines produced by intersection of the fields of these salts with those of metastable forms.
R. T.

Solubility of magnesium, zinc, and lead silicofluorides. V. S. JATLOV and E. N. PINAEVSKAJA (J. Gen. Chem. Russ., 1938, **8**, 1665—1669).—Solubility data are recorded for the systems H_2O–$MgSiF_6$, –$ZnSiF_6$, and –$PbSiF_6$. The solid phases are ice and $MgSiF_6,6H_2O$, $ZnSiF_6,6H_2O$, and $PbSiF_6,2$ and $4H_2O$ (transition point, 59·5—59·7°).
R. T.

System ZnO–Na_2O–H_2O. R. SCHOLDER and G. HENDRICH (Z. anorg. Chem., 1939, **241**, 76—92).—The 20° and 100° isothermals, and a part of the 30° and 40° isothermals, have been determined. At 20° the stable solid phases are as follows : under 1—13·4N-NaOH, ZnO ; under 13·5—19·6N-NaOH, $NaZn(OH)_3$; and under 19·7—20·1N-NaOH, $Na_2Zn(OH)_4$. Rhombic $Zn(OH)_2$ and $NaZn(OH)_3,3H_2O$ appear as metastable solid phases. At 100°, in presence of ≯19N-

NaOH, the stable solid phase is ZnO, and in more conc. alkali $NaZn(OH)_3$. F. J. G.

Ternary system AlF_3–HF–H_2O. I. Tananaev (J. Gen. Chem. Russ., 1938, 8, 1120—1124).—The phase diagram, at 25°, consists of the solubility curves of $AlF_3,3H_2O$, and $H_3AlF_6,3H_2O$ and $6H_2O$. $HAl_2F_7,5H_2O$ (Deville, Compt. rend., 1856, 42, 52) is not confirmed. R. T.

Solubility isotherms and solid phases of the system V_2O_5–H_2SO_4–H_2O. S. Z. Makarov and A. G. Repa (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 451—462).—Solid phases $V_2O_5,3H_2O$, $V_2O_5,2H_2O$, V_2O_5,H_2O, and V_2O_5 have been identified. H_2O at 25° and 75°, respectively, dissolves 0·4% and 0·95%, and H_2SO_4 (93·44%) 0·13% at 75°. 50—60% H_2SO_4 dissolves >10% of V_2O_5. L. J. J.

Ice-field in the system $FeCl_3$–HCl–H_2O. N. S. Kurnakov and E. A. Nikitina (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 433—436).—The rectilinear isotherms found are ascribed to the absence of undissociated compounds in the system. L. J. J.

Equilibria of three liquid phases in ternary systems. R. V. Mertzlin (J. Gen. Chem. Russ., 1938, 8, 1742—1755).—The phase diagram (80° and 90°) is given for the system PhOH–H_2O–light petroleum; the system consists of 2 or 3 liquid phases. The results are at variance with the theses of Schreinemakers (A., 1898, ii, 329) and Hill (A., 1922, ii, 555; 1926, 26). A new scheme, based on the possibility of the simultaneous existence of two binodal curves arising from a single binary stratification, is proposed. R. T.

Freezing of solutions as a method of studying some problems of pure chemistry. XIII. Crystal–liquid equilibria in mixtures containing the antipodes of dichlorosuccinic acid and of lactamide. J. Timmermans, T. V. Laucker, and J. Jaffé (Bull. Soc. chim. Belg., 1939, 48, 33—70; cf. A., 1938, 1, 141).—The f.p. curves for systems containing one optically active form of $(CHCl\cdot CO_2H)_2$ (I) or of lactamide (II) together with another optically active substance have been studied. Usually replacement of one of the constituents by its optical enantiomeride does not change the form of the curve, but differences are found in the following cases : l-asparagine gives a eutectic with l-(I) but shows compound formation with d-(I); d-(I) gives a eutectic with d-(II) but shows compound formation with l-(II); d-mandelic acid gives a eutectic with d-(II) but shows compound formation with d-(II). On the hypothesis that the formation of a eutectic indicates a greater similarity of configuration than does the formation of a compound, configurations are assigned which agree with those given by Kuhn (A., 1928, 506) and Freudenberg (ibid., 154, 735). The resolution of the racemic forms of (I), $CHPhMe\cdot NH_2$, and lactic acid is discussed. F. H.

Homogenisation of metastable stratification in the ternary system : anthranilic acid–water–pyridine. E. F. Shuravlev (J. Gen. Chem. Russ., 1938, 8, 1704—1710).—The fusion diagram of the system anthranilic acid (I)–C_5H_5N suggests a 1 : 1 compound, transition point 25·7°. A region of

stratification with an upper crit. point is demonstrated for the system (I)–H_2O–C_5H_5N. R. T.

General principles which characterise multicomponent mutual systems. Physico-chemical properties of multicomponent mutual systems. Topological structure of the stable complexes of multicomponent mutual systems and the classification of their diagrams. V. P. Radischev (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 380—384, 385—388, 389—391).—Theoretical. Tables are given of some geometric properties of the diagrams of composition of multicomponent mutual systems. The degree of interaction between components of the system is derived from the tables. Details of the structure of the diagrams and the cell complexes are included. D. F. R.

Polytherm of the quaternary system Na_2CO_3–Na_2SO_4–NaCl–H_2O and solid solutions of the berkeite type. S. Z. Makarov and V. P. Blidin (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 865—892).—Equilibrium diagrams for the three ternary systems including H_2O and for the quaternary system are given. Berkeite exists above 14·4° and consists of solid solutions of the components in the compound $2Na_2SO_4,Na_2CO_3$. F. J. G.

25° isotherm of the quaternary system $CaCl_2$–$MgCl_2$–NaCl–H_2O and the Perekop calcium chloride lakes. N. S. Kurnakov and A. V. Nikolaev (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 403—414).—The composition of the Perekop lakes over a period of 60 years is plotted. The change of composition of different lakes with varying $CaCl_2 : MgCl_2$ ratio in the NaCl region is linear, indicating a high purity of the deposited salt. Deposition of tachydrite is improbable. Deposition of bischofite with NaCl may commence after some years. L. J. J.

Heat of adsorption of hydrogen on platinum. L. Maidanovskaja and B. Bruns (Acta Physicochim. U.R.S.S., 1938, 9, 927—941).—Previously published vals. are reviewed and compared with vals. obtained by the authors. The heat of adsorption decreases from 18,000 to 15,000 g.-cal. with increase, from 0·178 to 0·355 µg., in the amount of H_2 adsorbed by 1 g. of Pt. C. R. H.

Heat of adsorption. E. Ledoux (Chim. et Ind., 1939, 41, 419—433).—A discussion of the interpretation of various published results. R. C. M.

Thermodynamics of reversible hydrogenation processes. G. Holst (Z. physikal. Chem., 1939, 183, 423—437).—Theoretical. Using the Nernst approximation formula, it can be shown that the entropy change in a reaction of the type $A + H_2 \rightarrow AH_2$ is ~30 entropy units. C. R. H.

Heat of formation of manganese nitrides. S. Satoh (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 35, 158—169).—The heats of formation of Mn_8N_2 and Mn_5N_2, from heat of dissociation and sp. heat measurements, are 79·8 and 57·0 kg.-cal. respectively. D. F. R.

Heat of combustion of standard substances for calibration of calorimeters. W. A. Roth

and A. E. LAMPRECHT (Rocz. Chem., 1938, 18, 747—754).—The heats of combustion of BzOH and $(CH_2 \cdot CO_2H)_2$ are recalc., applying a correction for production of HNO_3 during combustion.   R. T.

Heats of combustion of nitro-derivatives of the benzene series. M. BADOCHE (Bull. Soc. chim., 1939, [v], 6, 570—579).—The heats of combustion at const. vol. and at const. pressure have been determined for m-$C_6H_4(NO_2)_2$, 2 : 4- and 2 : 6-$C_6H_3Me(NO_2)_2$, 2 : 4- and 4 : 6-dinitro-m-xylene, 1 : 3 : 5-$C_6H_3(NO_2)_3$, 2 : 4 : 6-$C_6H_2Me(NO_2)_3$, and 2 : 4 : 6-trinitro-m-xylene. The influence of substituents is discussed.   C. R. H.

Microcalorimetric studies of anomalous heat effects. M. ŁAŹNIEWSKI (Rocz. Chem., 1938, 18, 691—697).—The spontaneous heat productions shown by Sb_2S_3, powdered Sb, and Sb–Al mixture correspond with a temp. rise of 0·0015°, 0·003°, and 0·0069° per hr., respectively, as measured by Swientosławski's method (A., 1934, 996 ; 1935, 57).   R. T.

Heat of adhesion in non-electrolyte solutions. II. HEILER and E. LANGE (Rocz. Chem., 1938, 18, 530—537).—Energy of solvation comprises (i) energy expended in making room for the solute mols., against cohesion of solvent mols., and (ii) heat evolved in forcing these mols. apart (termed " heat of adhesion "). Independently of the nature of the solvent (i) increases in the order : Ne, A, Kr, Xe, Rn ; H_2, O_2, Rn ; N_2, N_2O ; CO, CO_2 ; CH_4, C_2H_6, C_6H_6, n-C_7H_{16}, $C_{10}H_8$; CH_4, MeOH, EtOH, PhOH ; AcOH, $EtCO_2H$, BzOH ; $COMe_2$, EtOAc. For a given solute (ii) increases in the order : PrOH, EtOH, MeOH, H_2O ; AcOH, $COMe_2$, MeOH ; CCl_4, $CHCl_3$, PhCl ; C_5H_5N, NH_2Et, EtOH.   R. T.

Is the Le Chatelier–Matignon equation applicable to the reduction of ferrous oxide and of phosphoric anhydride ? C. DECROLY (Rev. École polytech., 1936, No. 10, 11 pp. ; Chem. Zentr., 1937, i, 782).—The equation $q/T = 0.032$ is not accurately applicable ; Nernst's equation is in much better agreement with the data for P_2O_5.   A. J. E. W.

Entropy of solution of hexane with hexadecane. J. H. HILDEBRAND and J. W. SWENY (J. Physical Chem., 1939, 43, 297—300).—The ratio of the v.p. of C_6H_{14} in $C_{16}H_{34}$ to the v.p. of pure C_6H_{14} increases linearly with increase in the mol. fraction of C_6H_{14}, and is nearly independent of temp.   C. R. H.

Electrochemical investigation of the system aluminium bromide–ammonium halide–ethyl bromide. V. A. PLOTNIKOV and I. BARMASCHENKO (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 5, 363—374).—Addition of NH_4Cl, NH_4Br, and NH_4I increases the sp. conductivity (κ) of solutions of $AlBr_3$ in EtBr. With a const. $[NH_4X]/[AlBr_3]$ ratio, κ is a max. when $[AlBr_3]/[EtBr]$ is 0·5. Anomalous vals. of κ are obtained when NH_4I is added to an equimol. mixture of $AlBr_3$ and EtBr. The exact compositions of mixtures yielding max. κ are recorded. Electrolysis of these solutions causes deposition of Al on the cathode. The decomp. potential in all three systems ($\sim$2·1 v.) is in accord with the val. for $AlBr_3$ calc. by Thomson's formula.   J. W. S.

Physico-chemical investigation of the systems bromine–pyridine and bromine–quinoline. V. A. PLOTNIKOV and V. I. MICHAILOVSKAJA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 5, 375—385).—Solutions of C_5H_5N and quinoline in Br have conductivities of the same order as aq. electrolytes. For Br–C_5H_5N mixtures the val. does not change with time, but with Br–quinoline mixtures the conductivity reaches its limiting val. only after several hr. Thermal analysis indicates the formation of solid solutions in the system Br–C_5H_5N.   J. W. S.

Poisoning and reactivation of hydrogen electrodes. H. JABŁCZYŃSKA-JĘDRZEJEWSKA and W. CHROSTOWSKI (Rocz. Chem., 1938, 18, 550—556).—The potential is stabilised when both the Pt electrode and the solution are saturated with H_2. Complete reactivation of an electrode poisoned with H_2S is achieved only by successive treatment with nascent O and H. The rate of inactivation by H_2S is inversely $\propto$ thickness of the Pt-black layer, of which the final potential is independent, and = 260 mv. HCN causes reversible inactivation ; that due to SO_2 is only partly reversible, owing to reduction of part of the SO_2 to H_2S. The potential is unaffected by the presence of reducing agents [$MnSO_4$, $FeSO_4$, 1 : 2 : 3-$C_6H_3(OH)_3$, MeOH, HCO_2H, CH_2O, or N_2H_4].   R. T.

Normal electrode potential of cæsium. H. E. BENT, G. S. FORBES, and A. F. FORZIATI (J. Amer. Chem. Soc., 1939, 61, 709—715).—Apparatus and technique for the study of the cells Cs|CsI in $NHMe_2$|Cs–Hg and Cs–Hg|aq. CsOH|HgO,Hg are described. E.m.f. measurements have been made and the vals. of $E°$ derived for the range 0—30° ; solid Cs has $E°$ 2·952 v. at 0° and 2·923 v. at 25° ; liquid Cs at 30° has $E°$ 2·914 v. The activity of Cs in 0·2827 at.-% Cs amalgam has been calc. for the above temp. and the changes in enthalpy and free energy have been evaluated.   E. S. H.

Potentials of zinc and cadmium in solutions of foreign ions. M. LOSCHKAREV (J. Phys. Chem. Russ., 1938, 12, 156—158).—The mechanism of formation of the potentials is discussed (cf. Boltunov, A., 1938, I, 254).   J. J. B.

Behaviour of mercury amalgams in solutions containing corresponding and other ions. T. ERDEY-GRÚZ and L. ERDEY (Z. physikal. Chem., 1939, 183, 401—422).—For Zn, Cd, Pb, Tl, and Cu amalgams in solutions containing Zn, Cd, Pb, Tl, and Cu ions, respectively, the observed potential (E) agrees with that calc. from the Nernst formula for ionic concn. $>10^{-5}N$. The presence of foreign ions affects E only slightly. In absence of the ion corresponding with the amalgam, the addition of foreign ions results in complex behaviour. As the concn. of foreign ions is increased, E remains almost const. until a concn. of 10^{-5}—$10^{-4}N$. is reached, when E rapidly attains a much more negative val. which, with further increase in concn., gradually becomes even more negative. Explanations of the variations of E are discussed.   C. R. H.

Amalgam activities and standard electrode potentials. II. Lead. M. M. HARING, M. R.

HATFIELD, and P. P. ZAPPONI (Trans. Electrochem. Soc., 1939, **75**, Preprint 15, 167—178).—From observations at 25° of the e.m.f. of the cell Pb amalgam (1)|Pb(OAc)$_2$ + AcOH|Pb amalgam (2) the activity of Pb in amalgams containing 0% Pb to saturation has been investigated. E_0 for Pb at 25°, determined from the e.m.f. of the cell H$_2$|Pb(ClO$_4$)$_2$ + HClO$_4$|Pb amalgam (sat.), is −0·1253±0·0005 v.
                                                     J. W. C.

Passivity of iron and steel in nitric acid. XXIV. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 1191—1223).—The electrode potential of Fe in HNO$_3$ is reduced by the addition of CO(NH$_2$)$_2$, HCl, or H$_2$SO$_4$. The ability to render Fe passive depends on the electrode potential and is inhibited by its reduction. On the other hand addition of NaNO$_2$ increases the electrode potential and hence the capacity of the HNO$_3$ to render Fe passive.   A. J. M.

Potential of a glass electrode in aqueous alcoholic solutions. N. A. IZMAILOV and M. A. BELGOVA (J. Gen. Chem. Russ., 1938, **8**, 1873—1880). —At p_H <7 the potentials found with a glass electrode in 40—70% EtOH are identical with those found for aq. solutions of the same p_H. At higher p_H, the potentials found are < in aq. solutions, to an extent increasing with rising [EtOH].   R. T.

Diffusion potentials in electrolytic mixtures. III. Theory for small potential gradient; extreme values in the concentrations. J. J. HERMANS (Rec. trav. chim., 1939, **58**, 259—265; cf. A., 1937, I, 139).—Assuming the gradients of concn. and potential to be small, it can be shown that the diffusion potential is independent of time and of the initial distribution. The formation of abnormally high and low concn. ("anomalous diffusion") is predicted by the theory, and is compared with so-called "anomalous osmosis." Experiments which bear out the theory are described.   C. R. H.

Saturated standard cells with small temperature coefficients. III. Cadmium–bismuth amalgams of constant cadmium activity. W. C. VOSBURGH and H. C. PARKS (J. Amer. Chem. Soc., 1939, **61**, 652—654; cf. A., 1937, I, 465).—The composition limits for const. Cd activity at 10—40° have been determined. An amalgam containing Cd 11, Bi 15, Hg 74% is recommended for use in modified Weston cells.   E. S. H.

Concentration cells of the amalgam type in fused salts. J. K. DELIMARSKI and L. S. BEREN-BLUM (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 479—485).—The e.m.f. of Zn amalgam concn. cells employing a mixture of fused AlCl$_3$, KCl, and ZnCl$_2$ as electrolyte have been measured with and without the introduction of a glass diaphragm. The latter does not affect the e.m.f. greatly, but makes results less reproducible. Divergences (≯0·05 v.) between the experimental results and the vals. calc. from the Nernst equation are probably due to the use of concns. instead of activities in this formula.
                                                     J. W. S.

Sensitisation of reversible photovoltaic cells. S. SCHLIVITCH (Compt. rend., 1939, **208**, 803—805).—

The Becquerel effect has been investigated in the cells Zn|ZnSO$_4$|Zn (I) and Cu|CuSO$_4$|Cu (II). (I) gives a slight positive effect only when one of the electrodes is illuminated by an arc, thus illustrating the thermal nature of this effect. Dipping the electrodes in a colouring solution (methylene-blue, uranine, rhodamine), or addition of one of these to the ZnSO$_4$, does not generally increase the sensitivity. Using conc. solutions of methylene-blue and illuminating with an arc, however, causes an increase in e.m.f. Immediately after its formation (II) does not show the Becquerel effect. After keeping in the CuSO$_4$, however, the Cu electrodes become covered with a coloured coating which is very sensitive to light. This sensitisation occurs for all concns. of CuSO$_4$, but is most spontaneous in very dil. solutions. Sensitisation of the Cu electrodes by colorants does not affect the nature of the cells, but increases the speed of sensitisation. (II), with the Cu electrodes sensitised by colorants, is analogous to a CuO cell.
                                                     W. R. A.

New electrochemical curves. V. MAJER (Z. Elektrochem., 1939, **45**, 253—254).—The polarograph used by Schmidt (A., 1938, I, 585) is similar to that described by the author (A., 1937, I, 567; 1938, I, 34).   J. W. S.

Polarographic curves. E. A. KANEVSKI (J. Gen. Chem. Russ., 1938, **8**, 1670—1676).—Ilkovic's formula for the strength of the diffusion current gives vals. close to, but not identical with, experimental results. Ionic valencies may be derived from polarographic curves.   R. T.

Polarographic study with inert polished electrodes. Analogy between the structure of a Beilby surface and the surface of liquid mercury. F. J. TABOURY (Compt. rend., 1939, **208**, 887—889).— A polished Pt electrode of very small dimensions behaves in aq. solutions like a Hg drop electrode, and similar polarograms can be obtained. The inflexion at ∼1·1 v. observed with a Hg electrode and attributed to dissolution of Hg (Revenda, A., 1935, 37) also appears with Pt, and is probably due to reaction between the solvent and OH′ ions. The results accord with the observation that a polished metal surface is amorphous.   J. W. S.

Polarographic studies with dropping mercury cathode.—See B., 1939, 353.

Interaction of electro-deposited metals with the cathode. K. M. GORBUNOVA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 893—904).—From a study of the potential–time curves in the electrodeposition of Cd on Cd–Ag alloys (10% and 40% Ag) it is concluded that diffusion of Cd into the alloy occurs, the diffusion coeff. being estimated at 6 × 10^{-7} sq. cm. per day.   F. J. G.

Transition phenomena with samarium ions in aqueous solution. L. HOLLECK (Z. Elektrochem., 1939, **45**, 249—253).—The shape of the p.d.–current curves for aq. SmCl$_3$ during electrolysis between Hg electrodes varies with time and with the pretreatment of the salt. Changes with time are particularly marked in presence of ZnCl$_2$. It is inferred that three forms of Sm‴ are involved, the

α-, β-, and γ-forms being stable at $>70°$, $40—70°$, and $<40°$, respectively. The α- and γ-forms of the ion discharge directly to form amalgamated metal, but the β-form is discharged only indirectly through reduction to Sm¨, which is discharged to the metal in a separate stage.　　　　　　　　J. W. S.

Keto–enol tautomerism of pyruvate ion studied polarographically. O. H. MÜLLER and J. P. BAUMBERGER (J. Amer. Chem. Soc., 1939, **61**, 590—596).—Polarographic evidence shows that the ratio keto/enol + enolate forms of pyruvate ion becomes 1 at p_H 5·8 and decreases with increasing p_H. $AcCO_2H$ polymerises even in fairly dil. solutions. The " polarographic half-wave potential " is equiv. to the " apparent reduction potential " and represents the E''_0 of the reversible step in an irreversible reaction. The apparent reduction potentials of the various forms of $AcCO_2H$ vary with p_H.　　E. S. H.

Passivity of iron and steel in nitric acid solution. XXV. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 42—59).—Fe undergoes rapid surface oxidation when used as anode in aq. HNO_3, becoming passive and evolving O_2 when its electrode potential (V) has exceeded the decomp. voltage of the solution. A short connexion of Zn lowers V and the production of the passive state is inhibited; the opposite effect is produced by Cu, Ag, Pt, and C. Cu in HNO_3 above 32·5% acts as anode to passive Fe and as cathode to active Fe.
　　　　　　　　　　　　　　　D. F. R.

Electrocrystallisation of metals with and without connexion of the electrode to earth with a continuous current and a high-voltage source of supply. E. S. SARKISOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 519—528).—In the absence of earth connexion a coarser-grained electrolytic deposit is produced, polarisation is increased, and passivation (in the case of Ag crystals) is diminished.　L. J. J.

Slow oxidation of methane. L. SLOTIN and D. W. G. STYLE (Trans. Faraday Soc., 1939, **35**, 420—426).—A method for determining the concn. of gaseous CH_2O in a mixture by measuring the intensity of the " D " absorption band is described, and applied to the study of the slow oxidation of CH_4 at ~430°. A relation between the rate of change of total pressure and $[CH_2O]$ is established.　　　F. L. U.

Combustion of methane. W. E. GARNER and A. J. HAM (Proc. Roy. Soc., 1939, **A, 170**, 80—101). —Ignition limits for flame in mixtures of $CH_4 + 2O_2$ were studied; the relations between pressure, temp., and length of induction period in the region 640—750° are in agreement with the Semenov equation. Analyses were made of CO_2, CO, H_2, CH_4, O_2, and CH_2O present in the gas at various times during the pre-flame, flame, and after-flame periods of the reaction. The sequence of processes which occurs during the generation of flame is discussed.
　　　　　　　　　　　　　　　G. D. P.

Mechanism of the formation of cold and hot flames of butane. M. B. NEUMANN and P. M. TUTAKIN (Acta Physicochim. U.R.S.S., 1938, **9**, 861—884, and Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 329—345).—The induction period, t_1, of the cold flame

of C_4H_{10} decreases with increasing pressure and temp. Comparison with data for C_3H_8 suggests that as the hydrocarbon mols. become more complex, changes in pressure and temp. exert stronger influences on t_1. Addition of NH_3 or N_2 decreases t_1. The induction period, t_2, of the hot flame increases with increase in temp. and with decrease in pressure, and decreases with the addition of N_2. The crit. pressure, p_k, and temp. of spontaneous combustion of Et_2O_2 are connected by $\log p_k = (2300/T) — 3·687$. Below p_k the decomp. of Et_2O_2 is a first-order reaction. Additions of Et_2O_2 to C_4H_{10}–O_2 mixtures reduce both flame temp. and t_1 and t_2. The data are discussed with reference to the chain theory of reactions.
　　　　　　　　　　　　　　　C. R. H.

Self-ignition of hydrocarbons on adiabatic compression. U. VON WEBER and A. RASTETTER (Naturwiss., 1939, **27**, 165—166).—In order to test the val. of hydrocarbon fuels for internal-combustion engines the self-ignition of mixtures of the hydrocarbons with air on adiabatic compression was investigated. The min. compression above which self-ignition takes place was determined. Knocking in the engine may be regarded as adiabatic self-ignition, and the order of fuels arranged according to ease of adiabatic ignition is the same as that of knocking capacity, viz., n-C_7H_{16}, n-C_6H_{14}, n-C_5H_{12}, iso-C_8H_{18}, PhMe.　　　　A. J. M.

Reaction kinetics of knock in motors.—See B., 1939, 348.

Oxidation of gaseous formaldehyde. F. F. SNOWDON and D. W. G. STYLE (Trans. Faraday Soc., 1939, **35**, 426—433).—The oxidation of CH_2O has been studied at ~300°, and a reaction scheme is put forward. The rate, except for a short initial period of acceleration, is given by $-dF/dt = KF(F — C)$, where $F = [CH_2O]$ and K and C are consts.
　　　　　　　　　　　　　　　F. L. U.

Mechanism of additions to double bonds. VI. Kinetics of gaseous associations. G. A. BENFORD and A. WASSERMANN (J.C.S., 1939, 362—367).—The association of *cyclo*pentadiene to *endo*dicyclopentadiene in the gas phase has been studied at 79—150° and at 154—735 mm. The reaction is bimol. and homogeneous. The energy of activation is 16·7 kg.-cal., and the non-exponential factor of the Arrhenius expression is $10^{6·1}$, so that the steric factor is $\ll 1$. The low steric factors in diene syntheses may be accounted for by the necessity for collision at two different and specified parts of the reacting mols.
　　　　　　　　　　　　　　　F. J. G.

Thermal decomposition of strontium azide crystals. J. MAGGS (Trans. Faraday Soc., 1939, **35**, 433—438).—The decomp. was studied at 99—124°. The reaction is similar to that observed with CaN_6 and BaN_6, the activation energy of the process causing acceleration being 20 kg.-cal. This val. is unaffected by radiation from Ra, the chief effect of which is to shorten the induction period and increase the val. of the acceleration coeff.　　F. L. U.

Thermal decomposition of potassium picrate. T. TUCHOLSKI (Rocz. Chem., 1938, **18**, 840—850).— K picrate undergoes autocatalytic decomp. at 287°. The reaction then degenerates, its velocity corre-

sponding with that of a chain reaction, until the temp. of the picrate is $>$ that of its environment. The decomp. velocity then rises rapidly, until explosion takes place at 310—325°.   R. T.

Velocity of transformation of hypoiodite into iodate and mechanism of the reaction. G. D'ESTE (Boll. Chim. farm., 1939, **78**, 117—124).— Velocity measurements show that the reaction $3I_2 + 6KOH = 5KI + KIO_3 + 3H_2O$ is of the second order at 24°. The rate-determining process is considered to be the formation of KIO_2 from the primarily formed KOI, followed by the rapid reaction $KIO_2 + KOI \rightarrow KIO_3 + KI$.   O. J. W.

Interconversion of acido- and aquo-rhodium pentammines. A. B. LAMB (J. Amer. Chem. Soc., 1939, **61**, 699—708).—The rates of transformation in solutions of bromide and chloride have been determined at 84° and 64° by conductivity measurements, and the positions of the equilibria determined from the precipitable halide. First-order reaction rates are obtained for both directions, although two reactants are involved in the aquo $\rightarrow$ acid reaction; the anomaly is ascribed to changes in the ionic strength of the solutions during the reaction. A modified kinetic equation, consistent with the results, has been derived. Solutions of bromo- and chloro-pentammines are rapidly converted into the corresponding hydroxopentammines by addition of NaOH, by a reaction which follows a simple second-order equation.   E. S. H.

Hydrolysis of nitriles with acids. V. K. KRIEBLE and C. I. NOLL (J. Amer. Chem. Soc., 1939, **61**, 560—563).—The rates of hydrolysis of aceto-, propio-, and α- and β-hydroxypropio-nitriles, and $CN \cdot CH_2 \cdot CO_2H$ have been studied. In presence of HCl the rate increases approx. as the square of the mean ion activity increases. H_2SO_4 is a less efficient catalyst than HCl. No relation between the acidity of the solutions and velocity of hydrolysis has been observed.   E. S. H.

Kinetics of isomerisation of aci- to nitro-forms of nitroethane in water and deuterium oxide. S. H. MARON and V. K. LA MER (J. Amer. Chem. Soc., 1939, **61**, 692—696).—The rates have been determined by a conductance method in presence of H_3O^+ in H_2O at 0° and 5°, and in presence of D_3O^+ in D_2O at 5°. The reaction occurs between the anion of aci-nitroethane and H_3O^+ or D_3O^+. The rate consts. for the reactions with H_3O^+ and D_3O^+ are the same at 5°. The energy and entropy of activation for the reaction in H_2O have been calc.   E. S. H.

Exchange of hydrogen atoms between nitrophenols and water. III. Activation energies. M. KOIZUMI and T. TITANI (Bull. Chem. Soc. Japan, 1939, **14**, 40—47, cf. A., 1938, I, 315).—The activation energy for the exchange of nuclear H between m- and p-$OH \cdot C_6H_4 \cdot NO_2$, and H_2O calc. from measurements of the rates of reaction in alkaline solution at 100°, 110°, 131°, and 139° is $29 \pm 1 \cdot 2$ kg.-cal. (m) and $28 \cdot 4 \pm 1$ kg.-cal. (p). These vals. are ~ 4 kg.-cal. $>$ the activation energy for the exchange of nuclear H in unsubstituted PhOH. The influence of the NO_2 on the exchange reaction is discussed.   F. H.

Influence of substituents on rates of decomposition of the potassium salts of dihydroxamic acids.—See A., 1939, II, 213.

Mechanism of cracking. I. Kinetics of inverse diene syntheses in solution and in the pure liquid state. B. S. KHAMBATA and A. WASSERMANN (J.C.S., 1939, 375—381).—The kinetics of the decomp. of cyclopentadienebenzoquinone and of cyclopentadiene-α-naphthaquinone in C_6H_6, and of endodicyclopentadiene in paraffin and in the pure liquid state have been studied at 49—175°. All three reactions in solution are unimol. and obey the Arrhenius equation, the non-exponential factors being respectively $10^{12 \cdot 6}$, $10^{11 \cdot 0}$, and $10^{13 \cdot 0}$, and the energies of activation respectively 29, 26, and $34 \cdot 2$ kg.-cal. The third reaction in the pure liquid state is probably unimol., with a non-exponential factor of 4×10^{13} and an activation energy of $35 \cdot 3$ kg.-cal.   F. J. G.

Mechanism of additions to double bonds. IX. Kinetics of the association of cyclopentadiene in carbon tetrachloride solution and in the pure liquid state. G. A. BENFORD, H. KAUFMANN, B. S. KHAMBATA, and A. WASSERMANN (J.C.S., 1939, 381—387).—The reaction $2(cyclopentadiene) = endodicyclopentadiene$ has been studied at 0—55° in CCl_4 and in the pure liquid state. The Br consumptions of the monomeride and the dimeride are not equal, and consequently the conclusions of Hammick and Langrish (A, 1937, II, 283), based on experiments in which the reaction was followed by bromination, must be rejected. The reaction is bimol., and the rate is not affected by O_2, MeCN, or peroxides. The apparent temp.-dependence of the order of the reaction in the pure liquid state is due to the fact that at the beginning of a run the " solvent " is cyclopentadiene, whilst at the end it is dicyclopentadiene. The Arrhenius equation is obeyed, the energies of activation being $17 \cdot 1$ and $16 \cdot 2$ kg.-cal., and the non-exponential factors $10^{6 \cdot 7}$ and $10^{5 \cdot 8}$, for the CCl_4 solution and the pure liquid, respectively (cf. A., 1939, I, 261).   F. J. G.

Decomposition of naphthol ethers by halogen acids and by alcoholic caustic potash and determination of the velocity constants. G. B. KOLHATKAR and V. V. BAPAT (J. Univ. Bombay, 1938, **7**, 157—173).—The velocity coeffs. k of the decomp. reactions of ethers of naphthols and substituted naphthols in the presence of halogen acids with AcOH as solvent have been determined at 100°. For unsubstituted ethers k decreases in the order β-$C_{10}H_7 \cdot OR > \alpha$-$C_{10}H_7 \cdot OR >$ phenolic ethers, and k for Me ethers is $>$ for Et ethers. k for substituted $C_{10}H_7 \cdot OR$ is $<$ for the corresponding unsubstituted ethers, and the influence of the substituents on k is in the order Me $>$ Br $>$ Cl $>$ NO_2. k decreases as the amount of H_2O in the reaction mixture increases. The effect of HBr, HCl, and HI in decomp. ethers is in the order HI $>$ HBr $>$ HCl. Using HCO_2H, AcOH, $EtCO_2H$, and Pr^aCO_2H as solvents for the decomp., k decreases with decrease in the dielectric const., i.e., in the order given. Unlike the decomp. with acids, Cl-, Br-, and NO_2-substituted ethers decompose more rapidly than unsubstituted ethers when alcoholic KOH is used as decomp. agent. An additive

mechanism for the decomp. of ethers which partly explains the influence of substituents is suggested.
W. R. A.

Kinetics of reactions in heterogeneous systems. III. Hydrolysis of acid halides with water. D. KARVE and K. K. DOLE (J. Univ. Bombay, 1938, 7, 108—125; cf. A., 1936, 297).—The hydrolysis of 11 aromatic acid halides in liquid–liquid heterogeneous systems has been studied at 30°. The influence of electrolytes has been determined for $o\text{-}C_6H_4(COCl)_2$ and BzCl, and the temp. effect has been investigated for these and for $m\text{-}NO_2\cdot C_6H_4\cdot COCl$. The mechanism of heterogeneous liquid–liquid systems is explained on the basis of the modified Noyes–Whitney–Nernst theory of heterogeneous reactions. W. R. A.

Velocity of dissolution of copper in nitric acid. M. CENTNERSZWER and W. HELLER [with J. BRAUDE] (Rocz. Chem., 1938, 18, 425—433).—The velocity of dissolution of $Cu \propto [HNO_3]$, up to 4N., above which it rises abruptly; stirring retards the reaction. The temp. coeff. is 3·8 for N- and 4·0 for 2N-HNO_3, for the range 25—35°. Cu immersed in 4N-HNO_3 is thereby passivated with respect to <3N- but not to >4N-HNO_3. The reaction is accelerated by small amounts of KNO_2, $FeSO_4$, $K_2Cr_2O_7$, or $KMnO_4$. R. T.

Influence of cathodic and anodic polarisation on the rate of dissolution of metals. B. BOONSTRA (Rec. trav. chim., 1939, 58, 293—305).—A theoretical approach is made to the analysis of c.d.–potential curves obtained during the dissolution of metals in acids. The arguments are illustrated by curves for the dissolution of Zn in H_2SO_4 and Al in HCl.
C. R. H.

Velocity of dissolution of comminuted substances. VIII. Dissolution of potassium sulphate in water. IX. Dissolution of alums. W. JACEK (Rocz. Chem., 1939, 19, 116—121, 122—128).—VIII. The velocity of dissolution of K_2SO_4 has been measured, at 16—26°; the temp. coeff. is 1·51.

IX. The velocity of dissolution of NH_4 Fe, K Cr, and K Al alums in H_2O at 17—20° has been determined. R. T.

Persulphate–iodide reaction. Specific effects of cations. I. W. J. HOWELLS (J.C.S., 1939, 463—466).—At const. ionic strength in presence of various cations the reaction rate decreases in the order Cs·, Rb·, K·, NH_4·, Na·, Li·, H·. Possible interpretations in terms of activity coeffs., ionic radii, and viscosities are discussed. F. J. G.

New example of induced oxidation. W. P. JORISSEN and (MLLE.) A. C. B. DEKKING (Rocz. Chem., 1938, 18, 574—576).—Oxidation of AsO_3''' to AsO_4''' by O_2 is induced in alkaline solution by xanthine, which undergoes oxidation probably to allantoin and CO_2. R. T.

Reduction of silver ions by quinol. T. H. JAMES (J. Amer. Chem. Soc., 1939, 61, 648—652).—The reaction in slightly acid solution is catalysed strongly by colloidal Ag, Au, Pd, and Ag_2S. The rate of the reaction catalysed by Ag is $\propto$ [quinol] and $[Ag^·]^{2/3}$. The variation of rate with [OH′] indicates that non-ionised quinol and the univalent ion take

part in the reaction at p_H 5·15—6·27. The rate is $\propto$ the surface of the catalyst. The temp. coeff. at p_H 5·74 is approx. 2·1. A mechanism involving primary adsorption of Ag· at the surface of the catalyst is discussed. E. S. H.

Catalytic exchange of deuterium and hydrogen in hydrocarbons. L. FARKAS and A. FARKAS (Nature, 1939, 143, 244).—A relatively rapid rate of exchange of H takes place when mixtures of D_2 and $n\text{-}C_6H_{14}$ or cyclohexane are brought in contact with platinised Pt foil. Speeds are tabulated for temp. from 37° to 124°. The mechanism of these exchange reactions appears to involve the detachment of 1 H from the hydrocarbon (cf. A., 1937, I, 469). The method is convenient for the prep. of deuterated hydrocarbons. L. S. T.

Thermal dissociation of cerous carbonate. M. BLUMENTHAL and Z. SOTIROWA (Rocz. Chem., 1938, 18, 366—373).—$Ce_2(CO_3)_3$ dissociates when heated at 230° in a stream of CO_2, to yield $2Ce_2O_4,CO_2$; $Ce_2O_4,3CO_2$ is an intermediate. The reaction is catalysed by its decomp. products. R. T.

Preparation of low-temperature hydrogenation catalysts. B. D. SULLY (Chem. and Ind., 1939, 282—284).—Laboratory tests show that in the pptn. of $NiCO_3$ from $NiSO_4$ by Na_2CO_3 a catalyst of optimum activity may be obtained after the sixth washing of the ppt. For large-scale work a satisfactory mixing of the ppt. and wash-H_2O is obtained by use of the colloid mill. The mill may also be used in making mixed catalysts by mixing ppts. The activity of the catalyst is measured by grinding 2 g. of Ni with 100 g. of isopulegol in a paint mill and transferring to a pressure shaker at 70°/150 lb. pressure of H_2. The catalyst described will hydrogenate 80% to menthol in 40 min., and 5% of this catalyst in large-scale work will effect complete conversion of crotonaldehyde into BuOH at 80°/200 lb. H_2 in 5 hr. D. F. R.

"Phosphatatic" action of hydrogels. E. BAMANN (Angew. Chem., 1939, 52, 186—188).—A summary (cf. A., 1938, I, 629; II, 399; 1939, I, 34). F. J. G.

Amphoteric metal hydroxides as mono- and poly-component catalysts, in the rôle of inorganic enzymes. XLIX. A. KRAUSE (Rocz. Chem., 1939, 19, 129—134).—Hydrated CuO added to amorphous $Fe(OH)_3$-$Mg(OH)_2$ mixture, prepared by simultaneous pptn., gives a highly active catalyst (Fe : Mg : Cu = 1 : 0·06 : 0·17) of the reaction $HCO_2H + 2H_2O_2 \rightarrow CO_2 + 2H_2O$, at 20°. The reaction mechanism is discussed. R. T.

Catalysis by means of aluminium chloride. C. D. NENITZESCU (Angew. Chem., 1939, 52, 231—238).—The development and commercial application of catalytic methods involving the use of $AlCl_3$, and reaction mechanisms in explanation thereof, are reviewed. C. R. H.

X-Ray analysis of mixed nickel catalysts for dehydrogenation–dehydration. A. M. RUBINSTEIN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 815—840).—The influence of the crystal structure of a no. of Ni–Al_2O_3 catalysts on their activity in the

·dehydrogenation and dehydration of *iso*-C_5H_{11}·OH has been studied. The catalysts consisted of α-Ni and γ-Al_2O_3 together with amorphous Al_2O_3, the dimensions of the primary crystals ranging from 40 to 122 A. for Ni and from 58 to 110 A. for Al_2O_3. There is a max. of activity in dehydrogenation for primary Ni crystals of 70—80 A. whilst the activity for dehydration increases with increasing size of the primary Al_2O_3 crystals. The unit-cell parameters varied somewhat around the normal vals. for the different catalysts, and the energy of activation for the dehydrogenation reaction decreased as the Ni parameter increased.   F. J. G.

Hydr[ogen]ation of aromatic hydrocarbons by Skita's method. A. F. NIKOLAEVA and P. V. PUTSCHKOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 913—917).—C_6H_6, PhMe, PhEt, PhPr^a, PhBu^a, and CH_2PhBu$^\beta$ are completely hydrogenated at room temp. by the action of H_2 under 4 atm. in presence of colloidal Pt in AcOH. The rate of reaction is greatest with PhMe and least with CH_2PhBu$^\beta$.
                   F. J. G.

Formation of catalytically active "ensembles" on surfaces. I. N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1938, 9, 805—844).—Examination of the author's results on the catalytic activity of Fe (cf. A., 1937, I, 36) suggests that the possessors of activity are amorphous at. groups consisting of definite nos. of atoms, groups containing fewer or more atoms being inactive. This amorphous phase is not part of the normal crystal. The cryst. phase acts as a carrier for the amorphous phase by permitting active group formation to take place in separate closed regions of "free migration." A mathematical development of the theory satisfactorily accounts for variations in optimum activity with concn. or dispersity, the influence of temp. of prep., and the action of promoters. Good catalysts, according to the theory, should be metals of high m.p.   C. R. H.

Catalytic aromatisation of aliphatic hydrocarbons.—See B., 1939, 347.

Catalytic alteration of mineral transformer oils.—See B., 1939, 350.

[Catalytic] hydrogenation of fusain.—See B., 1939, 341.

Electrolysis of fused mixtures of alkali silicofluorides and fluorides or oxides. M. DODERO (Compt. rend., 1939, 208, 799—801).—Fusion of SiF_4,2RF (R = Na, K) (I) at ~950° initiates decomp. with formation of SiF_4, and a clear solution of (I) in SiF_4 is obtained. Electrolysis of this solution using a cooled metal cathode gives R as primary product, which then acts on the bath solution giving Si. The reaction products are ultimately enclosed in a solid ball of the bath. This process has been extended to the prep. of metal silicides. Using a Cu cathode in a bath of fused (I) and MnF_2, crystals of Mn are obtained if the [MnF_2] is high. With a small [MnF_2], however, $SiMn_2$ is obtained. This compound is also obtained from electrolysis of fused (I) and MnO_2 using an Fe or C cathode. $SiCr_3$, $SiFe_2$, and Si_2Ti have been prepared similarly using CrF_2, Fe_2O_3, and TiO_2 respectively. The formation of these compounds is

due to simultaneous reduction of SiF_4 and the metal fluoride (or oxide).   W. R. A.

Principles of the genetic development of materials. X. Formation of elements of somatoidal structure in the electrolytic deposition of metals. V. KOHLSCHÜTTER and H. EGGENBERGER (Helv. Chim. Acta, 1939, 22, 283—310).—The electrolytic deposition of Ni, Cu, Ag, Cd, and Sb from various solutions has been studied with reference to the formation of somatoids. It is concluded that the formation of somatoids arises from interaction between crystallisation and surface forces, and the influence of various factors on this process is discussed.   J. W. S.

Electrolytic reduction of benzoic acid to benzyl alcohol.—See A., 1939, II, 210.

Electrochemical experiments with various organic acids. F. FICHTER (Trans. Electrochem. Soc., 1939, 75, Preprint 9, 73—94).—From a survey of the available data it is concluded that the Kolbe electrosynthesis is an oxidation process rather than a simple discharge of anions, since it can be carried out not only by anodic O, but also by powerful oxidising agents with intermediate formation of peroxides. Aromatic acids do not give the expected hydrocarbons owing to oxidation of the nucleus. The reduction of $CRR'Ac$·CO_2Et to $CHRR'Pr$ by intermediate transposition of Ac can be effected not only by a Pb cathode but also by Na–Pb alloy with dil. H_2SO_4. The electrolytic reaction of salts of aliphatic acids with nitrates to give higher alkyl nitrates is attributed to formation of alkylenes followed by their polymerisation by the highly conc. acid liberated.
                   F. R. G.

Mechanism of the Kolbe electrosynthesis and allied reactions. S. GLASSTONE and A. HICKLING (Trans. Electrochem. Soc., 1939, 75, Preprint 14, 149—166).—The discharged ion and the peroxide theories are considered inadequate to explain the Kolbe reaction. The authors' theory of electrolytic oxidation (A., 1935, 176; 1936, 942) through intermediate formation of H_2O_2 is summarised.
                   F. R. G.

Electrolytic preparation of 2 : 4-dinitrobenzoic acid from 2 : 4-dinitrotoluene.—See A., 1939, II, 213.

Electrochemical reduction in acid solution of *p*-nitrophenetole.—See A., 1939, II, 210.

Verification of the Faraday laws at the positive pole in electrolysis by spark. P. DE BECO (Compt. rend., 1939, 208, 797—798; cf. A., 1936, 799).—Comparison of the acid yields obtained at the positive pole by electrolysis of 0·1N-Na_2SO_4, KNO_3, and NaCl (in atm. of H_2 and of O_2), 0·1N-KH_2PO_4 and KI (in O_2), 0·2N-NaOAc (in H_2 and in O_2), and N-NaOAc (in O_2) by electrodes and by spark, using an apparatus in which diffusion and transport of ions are prevented, distinguishes between two types of salts. The sulphates, nitrates, phosphates, and chlorides give an acidity at the positive pole verifying Faraday's law. The acetates and iodides, the corresponding acids of which are easily oxidised or reduced

by the spark action, give no acidity at the positive pole. W. R. A.

Mechanism of formation of nitric oxide in the electric arc. M. BODENSTEIN (Rocz. Chem., 1938, **18**, 374—381).—Haber and König's results (A., 1908, ii, 34) agree with the equations $[NO] = [O_2]/\{1 + \sqrt{(m[O_2]/[N_2])}\} - 0.08[NO]^2$, or $[NO] = [O_2]/(1 + m[O_2]/[N_2]) - 0.08[NO]^2$. R. T.

Action of high-frequency coronary discharge on ethylene.—See A., 1939, II, 197.

Photo-reaction between bromine and hydrogen peroxide in aqueous solution. A. E. CALLOW, R. O. GRIFFITH, and A. McKEOWN (Trans. Faraday Soc., 1939, **35**, 412—420; cf. A., 1937, I, 87).—The reaction between Br and H_2O_2 in aq. HBr has been studied at 20° and 30° with $\lambda\lambda$ 365 and 436 mμ. Quantum yields of 2—130 are obtained. A reaction scheme involving a chain mechanism, and satisfactorily accounting for the observations, is proposed. F. L. U.

Formation of iodic anhydride by photo-oxidation of organic iodides. I. Photo-oxidation of methylene iodide. II. Generality of the phenomenon. Photo-oxidation of solid iodoform and carbon tetraiodide. G. EMSCHWILLER (Bull. Soc. chim., 1939, [v], **6**, 551—560, 561—570).—An extended account of work already reported (cf. A., 1938, I, 318; 1939, I, 153). C. R. H.

Mercury-sensitised decomposition in light of λ 1849 A. I. Carbon dioxide. J. E. CLINE and G. S. FORBES (J. Amer. Chem. Soc., 1939, **61**, 716—718).—H_2O-free CO_2, saturated with Hg vapour, is unaffected by resonance radiation of 2537 A., but is decomposed rapidly by λ 1849 A. The quantum yield of the decomp. is $\not< 0.8$. E. S. H.

Changes in quartz and glasses on irradiation. J. HOFFMANN (Glastech. Ber., 1936, **14**, 281—286; Chem. Zentr., 1937, i, 966).—Coloration of quartz on exposure to β-, γ-, or X-radiation is due to foreign substances included in the lattice. The ease of coloration is increased by tempering at high temp. Glasses in which SiO_2 is partly replaced by TiO_2 become brown on irradiation, owing to separation of TiO_2 loosely held in the lattice. Metallic salt constituents of glasses occur in lattice spaces, where they are exposed to the action of radiation. An increase in the $[SiO_2]$ causes a change in the colour produced on irradiation, due to the increased amount of included SiO_2 not forming part of the basic lattice. Irradiated glasses luminesce and lose their colour on keeping. Brown coloration of SiO_2 in lamps is due to free Si. A. J. E. W.

Oxidation of thin films of calcium exposed to light in presence of hydrogen. A. T. VARTANJAN (J. Gen. Chem. Russ., 1938, **8**, 1098—1105).—Ca is resistant to oxidation by O_2 after exposure to H_2, with which it forms a stable compound. The protective film can be removed by heat, that due to absorption of red and infra-red light from a C arc sufficing for the purpose. Disintegration of the film is more rapid in presence than in absence of O_2. The most stable films are obtained by exposure of Ca to H_2 after prolonged storage in high vac. in absence of O_2. Gradual access of O_2 causes formation of a protective CaO film. R. T.

Photoreduction of ferric compounds. M. PRASAD and C. R. TALPADE (J. Univ. Bombay, 1938, **7**, 235—244).—A review of existing results and theories. W. R. A.

Photochemical models in photographic science. F. WEIGERT (Phot. J., 1939, **79**, 121—131).—An account is given of photodichroism and of experiments with it which bear on the nature of a latent image. Exposure of an emulsion leads to two processes: (1) photolysis of AgBr to Ag + Br, Br being removed by the gelatin, and the Ag coagulating on the surface of the crystal; (ii) formation of a photomicelle by movement of an electron into the crystal, leaving Ag$^+$ outside, which, by attraction of anions of developer, is developable, development being catalysed by colloidal Ag. Numerous experiments bearing on the theory are discussed. J. L.

Theory of transverse photodichroism. S. NIKITINE (Compt. rend., 1939, **208**, 643—646; cf. A., 1938, I, 528). A. J. E. W.

Photochemistry in the Schumann ultra-violet [region of the spectrum]. W. GROTH (Z. Elektrochem., 1939, **45**, 262—285).—A review. The experimental technique of photochemical investigations in the ultra-violet region is discussed, and the principal results concerning the primary and total photochemical reactions and at. and ionic fluorescence are summarised. Applications to geophysical and astrophysical problems are indicated. J. W. S.

Action of visible and ultra-violet light on periodic reactions. T. KOFMAN (Compt. rend., 1939, **208**, 567—568).—The separation of Liesegang rings is reduced by illumination during their prep. (cf. A., 1933, 346); the reduction increases with decreasing λ, and is very marked at <3900 A. A. J. E. W.

Influence of hydrogen on the sensitised photochemical transformation of methane. W. KEMULA, J. CZORNODOLA, and Z. KOPNIAK (Rocz. Chem., 1938, **18**, 614—624).—The initial reactions taking place during illumination of CH_4 in presence of Hg, using a quartz–Hg vapour lamp, are: $Hg (1^1S_0) + h\nu \rightarrow Hg^* (2^3P_1)$; $Hg^* + CH_4 \rightarrow CH_3 + H + Hg$; $Hg^* + CH_4 \rightarrow CH_2 + H_2 + Hg$. These reactions are followed by: $CH_2 + H \rightarrow CH_3$; $CH_3 + H \rightarrow CH_2 + H_2$; $2CH_2 \rightarrow C_2H_4$; $2CH_3 \rightarrow C_2H_6$; $2CH_3 \rightarrow CH_4 + CH_2$; $CH_2 + CH_4 \rightarrow C_2H_6$; $2H \rightarrow H_2$; $CH_2 + CH_3 \rightarrow C_2H_5$; $2C_2H_5 \rightarrow C_4H_{10}$; $2C_2H_5 \rightarrow C_2H_4 + C_2H_6$; $C_2H_6 + H \rightarrow C_2H_5 + H_2$; $C_2H_5 + CH_3 \rightarrow C_3H_8$; $C_2H_4 + H \rightarrow C_2H_5$; $C_2H_5 + H \rightarrow C_2H_6$. With time, in view of accumulation of H_2, the reaction $Hg^* + H_2 \rightarrow 2H + Hg$ begins to dominate over that of Hg^* with CH_4; as a result, the reaction $CH_2 + H \rightarrow CH_3$ becomes dominant, and the reactions are prevailingly those involving CH_3. R. T.

Photochemical oxidation of crotonaldehyde. F. E. BLACET and D. H. VOLMAN (J. Amer. Chem. Soc., 1939, **61**, 582—584).—The quantum yield ϕ for oxidation of crotonaldehyde vapour by O_2 at 30° increases steadily over the range $\lambda\lambda$ 3660—2380, showing no apparent correlation with type of absorp-

tion. With const. pressure of crotonaldehyde, ϕ remains const. with increase of O_2 pressure at λ 3130 and 2804, but ϕ increases at λ 2537. A chain mechanism is indicated. Introduction of N_2 decreases ϕ, indicating that activated mols. are involved.   E. S. H.

Evolution of topochemistry. H. W. KOHL-SCHÜTTER and L. SPRENGER (Angew. Chem., 1939, 52, 197—202).—A review.   F. J. G.

Topochemical reactions of hydroxides and basic salts. W. FEITKNECHT (Angew. Chem., 1939, 52, 202—208).—A summary.   F. J. G.

Reactions between solid phases. G. JANDER (Österr. Chem.-Ztg., 1939, 42, 145—151).—A review.

(A) Lithium isopolytungstates. V. I. SPITZIN, I. M. KULESCHOV, and I. I. TICHOMIROV, (B) Crystalline lithium metatungstate. V. I. SPITZIN, N. I. SIDOROV, and I. I. TICHOMIROV. (C) Reduction of lithium tungstates by hydrogen. V. I. SPITZIN, A. I. KATSCHALOV, and N. I. SIDOROV (J. Gen. Chem. Russ., 1938, 8, 1527—1533, 1549—1551, 1892—1898). —(A) Li_2O–WO_3 mixtures, fused at 750—850°, yield Li_2WO_4 (I) in the case of 1 : 1, and $Li_2W_2O_7$ (II) in the case of 1 : 2, 1 : 3, and 1 : 4 mixtures. $Li_2W_4O_{13},10H_2O$ (III) or $Li_{10}W_{12}O_{41},33H_2O$ (IV) (prepared by heating an aq. suspension of Li_2CO_3 with a 10% excess of WO_3 at 75—80°) dissociates at 850° to yield (II) and WO_3. (II) undergoes partial dissociation at 850°, whilst prolonged treatment with boiling H_2O converts (II) into (IV) and (I).

(B) (III) is obtained in cryst. form from solutions containing 78% of anhyd. salt. The salt is distinguished by its exceptionally high solubility (15·1 g. dissolve in 1 g. of H_2O). Tensimetric measurements suggest the hydrates $Li_2W_4O_{13},1$ and $3H_2O$.

(c) Reduction of (I) by H_2 commences at 425°, of (II) at 350°, and of (III) and (IV) at 275°. (I) is quantitatively reduced to W at 1000—1200°, (II) to (I) and W or WO_2 and W_2O_5 at 500—700°, and (III) and (IV) to (II) and $WO_2 + W_2O_5$ at 400—500°.   R. T.

Action of carbon monoxide on ammoniacal copper chromate solutions. K. LESCHEWSKI and K. KOTHE (Z. anorg. Chem., 1939, 240, 322—330; cf. A., 1938, I, 531).—CO does not reduce $(NH_4)_2CrO_4$ in aq. or ammoniacal solution, nor does it reduce normal or basic Cu chromate in H_2O, but Cu^I in ammoniacal solution is slowly oxidised by CrO_4'' with formation of Cr^{III}. Ammoniacal solutions of $CuCrO_4$ only very slowly absorb CO, but those of the basic chromate absorb it readily, the absorption being accelerated by addition of $Cu(OH)_2$ but retarded by excess of CrO_4''. The retardation is due to oxidation by CrO_4'' of the Cu^I, the presence of which is necessary for rapid absorption, but as this oxidation is slower than the combination of Cu^I with CO, the absorption, when once started, can proceed. In the course of the reaction $Cr(OH)_3$ is slowly pptd., and the final state of saturation with CO depends only on [Cu]. The compound $CuCrO_4,4NH_3$ separates slowly from a solution of basic Cu chromate in 10% NH_3.   F. J. G.

Reducibility of beryllium oxide. W. KROLL (Z. anorg. Chem., 1939, 240, 331—336; cf. A., 1934, 1174).—BeO is reduced by Ti at 1400° in a high vac., the Be volatilising and condensing as a coherent deposit. At higher temp. the sublimate is a grey powder consisting of Be, Ti, and much TiO. The reduction of BeO by Ca or Mg is possible in presence of finely-divided Fe or Ni at such a temp. that Be alloys with them by diffusion. The reduction is carried out at 1000° under A, with $CaCl_2 + BaCl_2$ as a flux, and the product, after treatment with AcOH, may be separated magnetically, and the finely-divided alloy fused under A.   F. J. G.

Active substances. XXXVII. Thermochemical and X-ray investigation of the processes in the formation of zinc iron spinel from active zinc oxide and various active forms of ferric oxide. R. FRICKE and W. DÜRR [with E. GWINNER] (Z. Elektrochem., 1939, 45, 254—262).—Details are given of results previously recorded (A., 1938, I, 519).   J. W. S.

Preparation of silicon tetrachloride [from andesite].—See B., 1939, 375.

Reactions with chlorine of some derivatives of the phosphonitrile radical. G. WÉTROFF (Compt. rend., 1939, 208, 580—583).—P_3N_5 and P_4N_6 yield PN chlorides, chiefly $(PNCl_2)_3$, with Cl_2 at >700°, showing that these compounds are $[(PN)_3N_2]_n$ and a PN sub-nitride, respectively. P_3N_5 is probably the limit of a series of nitridised compounds formed by attachment of N to polymeric PN chains. $(OPN)_n$ reacts with Cl_2 at >800°, giving $POCl_3$ with very small amounts of $(PNCl_2)_n$; this shows that the P–N linkings are weaker than P–O linkings.   A. J. E. W.

Hydration of metaphosphoric acid in aqueous solutions. S. GLIXELLI and S. JAROSZÓWNA (Rocz. Chem., 1938, 18, 515—523).—The reaction of hydration of P_2O_5 is represented $P_2O_5 \rightarrow (HPO_3)_n \rightarrow H_4P_2O_7 \rightarrow H_3PO_4$; it proceeds to completion in 867 hr. at 25°, for $0·1M$-P_2O_5. The difference between the results of colorimetric and titrimetric (phenolphthalein) determination of H_3PO_4 in the solutions rises to a max. after 120—400 hr.; these differences are ascribed to formation of $H_4P_2O_7$ and of other unidentified acids, as intermediate products. The method of Travers and Chu (A., 1933, 1129) cannot be applied to the determination of small amounts of $H_4P_2O_7$ in presence of excess of H_3PO_4.   R. T.

Chlorination of niobium pentoxide and tetroxide. P. SÜE (Compt. rend., 1939, 208, 814—816).—Before Nb_2O_5 can be chlorinated it must be mixed with C. At ~300°, when Cl_2 is passed over a mixture of Nb_2O_5 and C (1 : 4), $NbCl_5$ and $NbOCl_3$ are formed. $NbCl_5$ is yellow; $NbOCl_3$ is white. If the vapours are carried by a stream of Cl_2 over C at 700° $NbOCl_3$ is reduced to $NbCl_5$. Nb_2O_4 reacts directly with Cl_2 at 200°: $5Nb_2O_4 + 5Cl_2 = 4Nb_2O_5 + 2NbCl_5$. The ratio $Nb_2O_5 : Nb_2O_4$ is 0·8, indicating the absence of $NbOCl_3$. $NbOCl_3$ may, however, be formed as an intermediate compound which is reduced by the Nb_2O_4 thus: $2NbOCl_3 + 2Cl_2 + 2Nb_2O_4 = 2Nb_2O_5 + 2NbCl_5$.   W. R. A.

Concentration of the heavy isotope of oxygen and isotopic analysis of water. O. K. Skarre and A. E. Brodski (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 565—568).—60% $H_2^{18}O$ has been obtained by distillation. Data are recorded for ρ and n of conc. samples. L. J. J.

Oxidation of sulphides by oxygen-enriched air. II. Oxidation of Cu_2S. N. P. Diev and J. V. Karjakin (J. Appl. Chem. Russ., 1938, **11**, 1389—1397).—At 500° in a stream of 10—60% O_2 the reaction $4Cu_2S + 9O_2 \rightarrow 6CuO + 2CuSO_4 + 2SO_2$ takes place. At 700° the reaction $Cu_2O + CuSO_4 \rightarrow 3CuO + SO_2$ occurs, 98% desulphuration being achieved in 72 min. in 10%, and in 28 min. in 60% O_2; at higher temp. (900°, 1100°) the accelerating effect of raising the $[O_2]$ is of the same order. R. T.

Preparation of chemically pure thionyl chloride. P. Carré and D. Libermann (Bull. Soc. chim., 1939, [v], **6**, 579—580).—$Bu^a_2SO_3$, prepared from S_2Cl_2 and Bu^aOH, is treated with NH_2Ph to form $NPh:SO$. HCl converts the latter at low temp. into $SOCl_2$ and NH_2Ph. This reaction is reversible at higher temp., and use can be made of this reversibility to purify commercial $SOCl_2$. C. R. H.

Reaction between sodium peroxide and sulphur monochloride. A. C. Batalin (J. Gen. Chem. Russ., 1938, **8**, 1541—1544).—Na_2O_2 reacts violently with S_2Cl_2, to yield S, Na_2S, Na_2SO_3, $Na_2S_2O_3$, Na_2SO_4, NaCl, Na_2O, SO_2, and O_2. R. T.

Reaction between sulphur dioxide and oxides of nitrogen. C. B. Medinski (J. Gen. Chem. Russ., 1938, **8**, 1562—1562).—SO_2 does not react with NO_2 in absence of H_2O. Since H_2O is bound by the reaction products the reaction does not proceed to completion in presence of limited amounts of H_2O. NO, N_2O_3, and O_2 do not take part in the reaction. The reaction is not promoted by light. R. T.

Potentiometric control in preparation of pure ammonium dichromate. L. E. Sabinina, A. A. Babalova, and L. V. Golovko (Zavod. Lab., 1938, **7**, 1355—1360).—Aq. NH_3 is added to aq. CrO_3, to p_H 5·4—5·8, measured potentiometrically (PbO_2 indicator electrode, Ag reference electrode). R. T.

Interchange between chromioxalate ion and oxalate ion, using radio-carbon. F. A. Long (J. Amer. Chem. Soc., 1939, **61**, 570—572).—At 35° exchange of C_2O_4'' is negligibly small, showing that racemisation of optically active $[Cr(C_2O_4)_3]'''$ (which occurs rapidly under the same conditions) does not involve ionisation of the co-ordination complex. E. S. H.

Determination of particle size and diffusion constants from emanation properties. (Theory of the emanation method.) S. Flügge and K. E. Zimens (Z. physikal. Chem., 1939, **42**, B, 179—220; cf. A., 1938, 1, 566).—Theoretical. W. R. A.

Investigations on chromium and iron hydroxides and their significance for the emanation method. L. G. Cook (Z. physikal. Chem., 1939, **42**, B, 221—239; cf. preceding abstract).—The thermal behaviour of $Cr(OH)_3$ (both below and above the burned-out temp.) and of $Fe(OH)_3$ has been investigated in connexion with the emanation method. The relation between the curve of emanation properties and the " Platzwechsel " temp. is discussed, and the " relaxation " effects of Hahn and Senftner (cf. A., 1935, 32) are considered. W. R. A.

Chrome-tanning compounds.—See B., 1939, 411.

Preparation of soluble molybdic acid. (Mlle.) M. Murgier (Compt. rend., 1939, **208**, 583—584).—$Ba_3Mo_7O_{24}$ (I) is pptd. on treating $(NH_4)_3Mo_7O_{24}$ with $BaCl_2$ in aq. solution at 40°. (I) is decomposed with dil. H_2SO_4 ($<$ theoretical quantity); the filtrate contains >2 g.-mol. of MoO_3 per l., and is stable for ~ 1 week. Practical details are given. A. J. E. W.

Quadrivalent molybdenum. III. Oxychloromolybdous acid. Stability of acid solutions of quadrivalent molybdenum. W. F. Jakób and L. Cyrus-Sobolewski. **IV. Decomposition of molybdo-octacyanic acid. Dicyanic acids.** W. F. Jakób and E. Schmidtgal (Rocz. Chem., 1939, **19**, 146—150, 151—155).—III. $K_4[Mo(CN)_4(OH)_4]$ heated with dil. HCl yields $Mo(CN)_2(OH)_2$, which is boiled under reflux (3 hr.) with conc. HCl. The solution is conc. in vac. to a syrup, which is extracted with Et_2O. This dissolves $H_2Mo^VOCl_5$, leaving H_3MoCl_6 in the aq. layer, from which a violet oil separates, yielding solid $MoCl_3(OH),3H_2O$ (I) when dried. Solutions of (I) are violet, yield a brown ppt. with aq. NH_3, and do not change colour with CNS′ or MoO_4''.

IV. $K_4Mo(CN)_8$ boiled with 3% H_2SO_4 yields HCN and $Mo(CN)_2(OH)_2,xH_2O$, oxidised by H_2O_2 to $H_4Mo(CN)_8,3MoO_2,xH_2O$. R. T.

Tanning action of acid salts of isopoly-acids of tungsten, molybdenum, and vanadium, and of phosphotungstates.—See B., 1939, 411.

Bromine oxides. II. R. Schwarz and H. Wiele (J. pr. Chem., 1939, [ii], **152**, 157—176; cf. A., 1937, I, 421).—BrO_2 (improvements in method of prep. described) is completely stable below −40°, but above this temp. undergoes a slow but continuous decomp. into its components. It does not dissolve unchanged in CCl_4 or light petroleum, in H_2O gives a solution smelling slightly of Br, and in 2N-NH_3 affords NH_4BrO_3 and NH_4Br. With hot 5N-NaOH BrO_2 reacts thus : $6BrO_2 + 6NaOH = 5NaBrO_3 + NaBr + 3H_2O$; $2BrO_2 + 2NaOH = NaBrO_3 + NaBrO_2 + H_2O$; $4BrO_2 + 4NaOH = 3NaBrO_3 + NaOBr + H_2O$. Thermal decomp. of BrO_2 under normal pressure gives Br and O_2 whereas in a high vac. the brown *dibromine oxide* and a colourless *substance* are also produced. Br_2O has a powerful odour of $CaOCl_2$. It dissolves in CCl_4 to a moss-green solution which is stable at low temp.; addition of I to it causes pptn. of I_2O_5. If the solution is shaken with 2N-NaOH there is almost quant. formation of NaOBr. Direct reaction of Br_2O with well-cooled 2N-NaOH occurs thus : $6Br_2O + 12NaOH = 9NaOBr + NaBrO_3 + 2NaBr + 6H_2O$. In H_2O there appears to be an intermediate production of HOBr, which immediately commences to decompose. Br_2O can be sublimed, but is partly decomposed in the process. It has m.p. −17·5±0·5° (slight decomp.). At −16° it forms a

black-brown liquid from which gas is continuously evolved and after a short time the liquid assumes the colour of Br. Br_2O is probably formed by the reactions : $8BrO_2 = 2Br_2O_7 + 2Br_2 + O_2$ and $Br_2O_7 + 6Br_2 = 7Br_2O$. Attempts to isolate the white oxide were unsuccessful.   H. W.

Complex chlorides of quadrivalent rhenium. B. JEŻOWSKA-TRZEBIATOWSKA and C. JODKO (Rocz. Chem., 1939, **19**, 187—198).—$HReO_4$ in 30% HCl and MI (24 hr. at 20° in a CO_2 atm.) yield $M_4[Re_2OCl_{10}]$ (M = K, NH_4, quinoline), together with $M_2[ReCl_5OH]$ (M = K, NH_4, Rb, quinoline) and M_2ReCl_6.   R. T.

Structural elements of amorphous iron hydroxide. H. W. KOHLSCHÜTTER and E. KALIPPKE (Z. physikal. Chem., 1939, **42**, B, 249—273).—On adding aq. NH_3 to a solution of $Fe(NO_3)_3$ (" neutral " solution) a ppt. of $Fe(OH)_3$ is thrown down and a solution of the " basic " nitrate is obtained. The two solutions differ in light transmission, velocity of ageing, streaming double refraction, and the reaction with dil. HNO_3. The ageing, dehydration, and reaction with dil. HNO_3 of the ppt. are discussed.   W. R. A.

Basic cobalt trichloroacetate. A. ABLOV (Bull. Soc. chim., 1939, [v], **6**, 491—493).—A solution of $(CCl_3 \cdot CO_2)_2Co,4H_2O$ in EtOH (95%) deposits, on long keeping, red $2(CCl_3 \cdot CO_2)_2Co,Co(OH)_2,4EtOH$. Neither MeOH nor Pr^aOH forms similar compounds.   C. R. H.

Study of stereoisomerism and isomerisation of some complex platinum compounds by the method of heating curves. Enlarging crystals of metallic platinum. A. V. NIKOLAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 571—574).—Heating curves showing stops corresponding with isomerisation of *cis-* to *trans-*forms, decomp. of *trans-*forms, and growth of metallic Pt crystals, are described for $(NH_4)_2PtCl_6$, Peyronnet's salt (*cis*), chloride of Reiset's II base (*trans*), and Magnus' green salt.   L. J. J.

Complex components of platinum and 2-aminopyridine.—See A., 1939, II, 226.

Detection and determination of poisonous gases etc. in air.—See B., 1939, 445.

Analysis of combustible gases.—See B., 1939, 342.

Accurate analysis of gaseous mixtures. B. LAMBERT and D. J. BORGARS (Phil. Trans., 1939, **A**, **237**, 541—565).—An apparatus and technique for the analysis of small vols. of gaseous mixtures are described and illustrated. With ~10 c.c. of gas, vals. for the % content of one constituent of the mixture are accurate to $\pm 0.02\%$; with 1—2 c.c. of gas, an accuracy of $\pm 0.1\%$ has been obtained. Test data for O_2 in air, in $O_2 + H_2$, and $O_2 + CO$, for H_2 in $H_2 + A$, in $H_2 + N_2$, and for CO in $CO + N_2$ are recorded. O_2 is generally removed by absorption with NaOH + $Na_2S_2O_4$ + Fieser's catalyst, but in the accurate analysis of $CO + O_2$, the NaOH must be replaced by a saturated solution of Na_3PO_4. Absorption processes for the removal of CO are untrustworthy, and the only effective method is to oxidise it to CO_2, which is then absorbed. The complete oxidation of CO to

CO_2 requires three successive " burning " operations with O_2, with intermediate removal of the CO_2 and " degassing " of the Pt spiral used for the combustion.   L. S. T.

Determining hydrogen by absorption in technical gas analysis.—See B., 1939, 342.

Theory and practice of photo-electric volumetric analysis. A. RINGBOM and F. SUNDMAN (Z. anal. Chem., 1939, **116**, 104—118; cf. A., 1939, 1, 212).—The theory of photo-electric neutralisation titration is worked out, and expressions showing the accuracy attainable in a measurement of p_H are derived. These enable the best working conditions with regard to choice and concn. of indicator to be determined. Working details for photo-electric titrations using the Lange photo-electric colorimeter are given. The equiv. point can be determined to ± 0.01 p_H unit, and hence acids or bases with $K \lessdot 10^{-8}$ can be accurately titrated in 0.01N. solution ; titrations of polybasic acids or polyacid bases to a definite stage are also possible. Examples illustrating the range of application of these titration methods are tabulated.   L. S. T.

Standardisation of hydrochloric acid. A. J. BERRY (Analyst, 1939, **64**, 189—190).—The vol. of 0.1N-HCl $\equiv$ 1 l. of 0.1N-AgCl (phenosafranine or tartrazine) averaged 1003 ml., whilst that $\equiv$ 1 l. of 0.1N-$KHCO_3$ (screened Me-orange to p_H 3.8) was 1005 ml.   E. C. S.

Volumetric and potentiometric determination of hydrogen peroxide and persulphuric acids present together. M. A. BODIN (Zavod. Lab., 1938, **7**, 1248—1250).—H_2SO_4 is added to 10 ml. of the solution, to 2N., and H_2O_2 is titrated with $KMnO_4$. 2—3 drops of I in EtOH are added, and the solution is titrated with 0.1N-$Na_2S_2O_3$ (1 ml. = 4.563 mg. H_2SO_5). 10 ml. of a special solution (10 g. of KI are added to 20 ml. of 5% $CuSO_4$, the I liberated is titrated with $Na_2S_2O_3$, and 25 g. of KCl are added, followed by H_2O to 100 ml.) are now added, and the solution is titrated with 0.1N-$Na_2S_2O_3$ (1 ml. = 11.42 mg. $H_2S_2O_8$).   R. T.

Micro-determination of halogen ions. Acido-alkalosis test. C. DUVAL and G. MAZARS (Compt. rend., 1939, **208**, 579—580).—A drop of the halide solution, containing $FeSO_4$, is placed on a disc of $Ag_4Fe(CN)_6$ emulsion, prepared by treating a Ag lactate (diapositive) photographic plate with $K_4Fe(CN)_6$; the colour obtained is compared with standards. The erythro-plasmatic chloride ratio is determined by applying the test to the plasma and corpuscles in tubes, using an aq. $Ag_4Fe(CN)_6$ suspension.   A. J. E. W.

Chemical analysis of fog nuclei in the air. E. QUITMANN and H. CAUER (Z. anal. Chem., 1939, **116**, 81—91).—H_2O containing fog nuclei is condensed on the surface of round-bottomed flasks containing cooling mixtures of Et_2O, or ice and salt, or liquid air, or solid CO_2 by the procedures described. The pptd. H_2O etc. is then collected and analysed in 0.2-c.c. portions for Cl', SO_4'', SO_3'', NO_2', NO_3', CO_3'', NH_4', and H_2O_2, and its p_H determined, by known colorimetric or turbidimetric methods.   L. S. T.

Determination of bromide in presence of chloride. A. J. BERRY (Analyst, 1939, **64**, 190—191).—Bugarsky's (A., 1896, ii, 216) and Andrews' (A., 1907, ii, 503) methods are modified by determining the excess of KIO_3 remaining after oxidation of the Br′ by reducing it to KI with Zn amalgam and titrating the KI with the original standard KIO_3. High results are obtained in presence of excess of Cl′.
     E. C. S.

Micro-determination of fluorine by thorium nitrate titration. F. J. McCLURE (Ind. Eng. Chem. [Anal.], 1939, **11**, 171—173).—The accuracy obtained by Armstrong (A., 1936, 1351) in this titration could not be reproduced. The end-point is difficult and frequently uncertain, and scarcely sensitive to a variation of <0.15—0.25 µg. of F′. The relatively large blank restricts the titration to aliquot portions containing $\ll 2$ µg. of F. The recovery of 50—100 µg. of F′ added to bone ash varied by $\sim \pm 5$ µg., whilst duplicate analyses of bone and tooth ash containing similar amounts of F′ agreed to within 2 to 6 µg. of total F. Application of the method to milk powder containing <1.0 p.p.m. of F was unsuccessful. Interference in the $Th(NO_3)_4$ titration owing to the volatilisation of HCl during the distillation is effectively overcome by addition of Ag_2SO_4 to the distilling flask. Comparative data for the evaporation of alkaline solutions of NaF in glass, porcelain, and Pt show that recoveries of F′ are generally low in the first two cases, and that Pt only must be used.   L. S. T.

Determination of fluorine in silicate rocks. O. HACKL (Z. anal. Chem., 1939, **116**, 92—101).—The method involving the bleaching of pertitanic acid with aq. NaF is sensitive to only 0·3 mg. of F in presence of much Na_2SO_4. Bleaching of $Fe(CNS)_3$ by F′ is sensitive to 0·01 mg. of F′ in pure solutions, but in presence of the KCl introduced in an analysis, the sensitivity is markedly reduced. Neutralisation with AcOH of the carbonate used in the fusion makes the interference by added salts less serious. Small amounts of H_3BO_3, such as occur in rocks, have practically no effect on the test. Giammarino's LaF_3 method (A., 1937, I, 260) offers no marked improvement in sensitivity for F′ in silicates, neither does pptn. of ScF_3 with $Sc_2(SO_4)_3$. The Zr–alizarin method is more sensitive than the above method for determining F in rocks. It is unaffected by the SiO_2 remaining in solution after the $(NH_4)_2CO_3$ treatment, and by the small amounts of B_2O_3 generally present. Large amounts of CrO_4'' and $>0.5\%$ of P_2O_5 must be removed in the usual way with Ag˙, and an amount of Na_2CO_3 + acid equal to that used in the fusion and subsequent acidification must be added to the comparison solution.
     L. S. T.

Application of salts of complex cations to the microscopic detection of anions. VII. Carbonatotetramminocobaltic nitrate. W. A. HYNES and L. K. YANOWSKI (Mickrochem., 1939, **26**, 245—247; cf. A., 1939, I, 214).—1 : 6-$[Co(NH_3)_4(CO_3)]NO_3$ yields characteristic tablets with HF_2' and needles with BrO_3'. Turbidities are also obtained with various other ions, which are enumerated, but these do not become cryst. during 10 min.   J. W. S.

Determination of fluorine with special reference to the analysis of natural phosphates and phosphatic fertilisers.—See B., 1939, 373.

Volumetric determination of sulphur and sulphate ion. B. JOSEPHSON (Analyst, 1939, **64**, 181—185).—SO_4'' is pptd. with Ba˙˙, the excess of Ba˙˙ is pptd. with CrO_4'', and the excess of CrO_4'' is titrated with $Na_2S_2O_3$. The method is detailed, with a modification for minute quantities. Uniform pptn. of $BaCrO_4$ is ensured by the presence of NaOAc buffer. An adaptation of Kahane's process for the oxidation of S in org. material (cf. A., 1934, 910) is described.
     E. C. S.

Volumetric determination of sulphur by Carius' method. A. WERNER (Angew. Chem., 1939, **52**, 139—140; cf. Callegari, A., 1937, III, 378).—3—5 mg. of the substance, with a few particles of NaCl or $NaNO_3$, are decomposed with HNO_3 in the micro-bomb, the contents of which are then transferred to a tube, evaporated to dryness, and redissolved in 5 c.c. of H_2O. 2 c.c. of 0·02N-$BaCl_2$, a few particles of NaOAc, and 1 c.c. of 3% aq. $K_2Cr_2O_7$ are added in succession. The solution is heated on the water-bath (5 min.) and filtered. The ppt. is washed with aq. NaOAc and the $BaCrO_4$ is dissolved in conc. HCl. 2 c.c. of 5% aq. KI are added to the filtrate (made up to 20 c.c.), which is then titrated with 0·01N-$Na_2S_2O_3$. Determinations of S in a no. of org. compounds show satisfactory accuracy.   A. B. M.

Combustion method of determining sulphur. M. K. TSCHUKAVIN and M. N. MARKELOVA (Zavod. Lab., 1938, **7**, 1455—1456).—Oxides of S may be absorbed equally well in I in KI, H_2O_2, or $AgNO_3$ solutions.   R. T.

Ter Meulen hydrogenation method of determining sulphur in gas.—See B., 1939, 342.

Determination of sulphur in coal.—See B., 1939, 340.

Determination of thiocarbamide and thiocyanates.—See A., 1939, II, 195.

Application of mercurous nitrate to determination of selenites and selenates. T. ESTREICHER and W. HUBICKI (Rocz. Chem., 1938, **18**, 496—501).—0·1N-$HgNO_3$ is added gradually to the slightly acid solution, containing SeO_3'', but not other anions giving ppts. with Hg, and the ppt. is washed, dried at 120°, and weighed as Hg_2SeO_3. This procedure is not applicable to the determination of SeO_4''.   R. T.

Determination of nitrogen in [solid] fuels.—See B., 1939, 340.

Ignition of phosphate precipitates in the classical determination of magnesium and phosphoric acid as magnesium pyrophosphate. K. SCHUHECKER (Z. anal. Chem., 1939, **116**, 14—20).—A process for the removal of C retained by the ppt., involving oxidation with NH_4ClO_4 and NH_4NO_3, is described.   L. S. T.

Titrations with polarometric end-point readings. A. NEUBERGER (Z. anal. Chem., 1939, **116**, 1—13).—The determination of PO_4''' by titration with $BiOClO_4$, using the polarometer which has been constructed by Abresch on polarographic principles to

determine the end-point, is described. End-points in other determinations, e.g., Ni with dimethylglyoxime, Cu with salicylaldoxime, and Pb with K_2CrO_4, can be found by similar procedures.   L. S. T.

Improved molybdenum-blue reagents for determination of phosphorus and arsenic. J. A. SCHRICKER and P. R. DAWSON (J. Assoc. Off. Agric. Chem., 1939, **22**, 167—179).—For the determination of P, the optimum concns. of reducing agent, H_2SO_4, and Mo oxide for min. interference of yellow tints, SiO_2, and salts are 0·0004N., 0·36N., and 0·0018M., respectively ($\equiv 0.02$M-$Mo_{10}O_{29}$). For As a higher concn. of Mo oxide, viz., 0·0032M., is necessary ($\equiv 0.02$M-$Mo_{17}O_{50}$). The improved reagents and procedures are developed accordingly and described in detail. Using the photo-electric colorimeter <1 µg. of P may be determined.   E. C. S.

Determination of arsenic. A. K. KLEIN and F. A. VORHES, jun. (J. Assoc. Off. Agric. Chem., 1939, **22**, 121—130).—Zinzadze's method (A., 1935, 1042) is modified by substituting Tarugi and Sorbini's separation (conversion into xanthate and extraction with CCl_4; cf. A., 1912, ii, 993) for the distillation which is otherwise necessary for removing interfering substances. The procedure is detailed. The method is more accurate than the Gutzeit and more rapid than others of comparable accuracy.   E. C. S.

Simplified apparatus for the determination of traces of arsenic alone and in presence of antimony. E. SZÉP and W. CIELESZKY (Z. anal. Chem., 1939, **116**, 34—38).—The solution containing As (and Sb) is heated with Sn and HCl in an Erlenmeyer flask, and the AsH_3 decomposed by passage through a heated quartz spiral, cooled by running H_2O at the end remote from the generator. The As mirror is dissolved in ICl and the liberated I titrated with 0·001M-KIO_3. For amounts of As up to 50 µg., alone or in presence of 100 µg. of Sb, the results are as accurate as those obtained with the more complicated apparatus of Gangl and Sanchez (cf. Bodnár et al., A., 1939, I, 215).   L. S. T.

Determination of arsenic by hypophosphites. J. LANGLOIS and C. MORIN (Bull. Sci. Pharmacol., 1938, **40**, 482—492).—The reagent consists of a solution containing 125 g. of $Ca_3(PO_2)_2$, 80 g. of CaI_2, and 1000 g. of conc. HCl. 8 c.c. are used for 4—5 c.c. of aq. As_2O_3. The solutions are mixed at 20° and a definite brownish coloration results after 20 sec. with 0·2 mg. of As_2O_3, whilst after 60 sec. the reaction is intense. 0·004 mg. of As_2O_3 can be detected. SO_4'' inhibits the reaction not only by causing pptn. of Ca but also owing to reduction to H_2S. Bi, Se, and Te also inhibit but Hg has no effect. The method is discussed in relation to those of Bougault and the French Codex of 1937. I' acts catalytically, affecting only the rate of reaction, whilst F', Cl', and Br' are inactive.   J. N. A.

Turbidimetric determination of carbon dioxide. P. S. ROLLER and G. ERVIN, jun. (Ind. Eng. Chem. [Anal.], 1939, **11**, 150—153).—The carbonate is decomposed by boiling with dil. HCl, the H_2O vapour is removed by condensation, the liberated CO_2 is flushed out with air into aq. $Ba(OH)_2$, and the pptd.

$BaCO_3$ is measured in a Hellige turbidimeter (B., 1935, 880). A blank must be run before each series of determinations. For $\not> 5$ mg. of CO_2 the average error is $\pm 2.6\%$, and from 5 to 10 mg. of CO_2 it is $\pm 3.2\%$. Most of this error is associated with the precision of the turbidimeter, which is $\sim \pm 2.0\%$. Data showing the effect of the rate of air flow and $[Ba(OH)_2]$ on the completeness of absorption of the CO_2, and the effect of time of boiling and rate of air flow on the completeness of its evolution, are recorded.   L. S. T.

Recovery of platinum used in the determination of potash. M. C. SWISHER and F. F. HUMMEL (Ind. Eng. Chem. [Anal.], 1939, **11**, 162—163).—H_2PtCl_6 in the wash liquids from the K determinations is pptd. with excess of NH_4Cl. The NH_4 and K platinichlorides are added as they accumulate to 2 l. of distilled H_2O and 25 c.c. of 85% HCO_2H and kept at room temp. In due course the solution is decanted, the residue washed free from Cl' with hot H_2O, and the Pt dissolved in HNO_3 + HCl in the usual way. The recovered H_2PtCl_6 is pure, and is diluted to ρ 1·1552 at 25° to give a 10% solution. The Pt obtained by HCO_2H reduction at 23—40° does not adhere to clean glass. Recovery of the Pt is practically 100%. 25 c.c. of 85% HCO_2H will reduce ~25 g. of R_2PtCl_6. Reduction of $PtCl_6''$ by HCO_2H is complete in a few min. at 100°, but requires 3—5 days at room temp. At high temp., soot-like Pt which adheres to glass is obtained. The Pt should not be washed with EtOH since reduced Pt in presence of EtOH and air deflagrates with the production of finely-divided C.   L. S. T.

Determination of potassium chlorate.—See B., 1939, 373.

New reagent for sodium.—See A., 1939, II, 177.

Detection of sodium carbonate in sodium hydrogen carbonate.—See B., 1939, 373.

Microchemical detection of metals of the first group in situ without previous separation. B. BERISSO (Mikrochem., 1939, **26**, 221—226).—Tests are carried out on a microscope slide on which 2—3 drops of solution are smeared in four parts. One part is stirred with such an amount of HNO_3 as adheres to a 3-mm. rod and 1 drop of aq. K_2CrO_4. In presence of Ag, red rhombohedra appear after a few sec. and grow with increasing velocity. A second portion is stirred with a drop of Co reagent [$Co(OAc)_2$ (1 part) and NH_4CNS (2—3 parts) dissolved in a min. of dil. AcOH] and a drop of dil. HNO_3. In presence of Hg^I blue rhombic micro-crystals are formed. Pb is detected as Cu K Pb nitrite. The three cations can also be pptd. as chlorides, which are separated with hot H_2O and aq. NH_3, Ag being detected microscopically as AgCl or as Ag Rb Au chloride. Pb can also be identified microscopically as $PbSO_4$.   J. W. S.

Flame spectrum analysis. T. TÖRÖK (Z. anal. Chem., 1939, **116**, 29—33).—A flame test equal in sensitivity to that of the usual Pt wire test can be obtained by adding Zn or aq. $(NH_4)_2CO_3$ to the HCl test solution in a crucible and allowing the flame of a Bunsen burner to play across the mouth of the

crucible. Solid particles carried by the gas evolved impart a brilliant colour to the whole flame. Sensitivities, expressed as % of the test solution, are Ba 0·03, Sr 0·008, Ca 0·004, Na 0·00008, K 0·04, and Li 0·0005. KOH + Al can replace the Zn + HCl or HCl + carbonate, but in this case the sensitivity of the test for Ba, Sr, and Ca is reduced. The effect of the more important anions on the test has been investigated. The inhibiting effect of PO_4''' on the spectrum of the alkaline earths can be partly overcome by adding H_2SO_4 to the test solution. An aq. solution containing 0·14% coccinin, 0·0014% dahlia-violet, and 0·7% $CuSO_4,5H_2O$ forms an effective light-filter for detecting $Li^{\cdot}$ in presence of $Na^{\cdot}$ and $K^{\cdot}$.   L. S. T.

Use of fluorine compounds in chemical analysis. I. TANANAEV and S. TALIPOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 547—553).—For the separation of Be from Ca and Mg a slight excess of NaF is sufficient; for separation from Al and Fe, 0·5 and 1·5 g. per l., respectively, is necessary.
                                L. J. J.

Titrimetric determination of magnesium. G. SZAMEK (Chem. Weekblad, 1939, **36**, 168—169).—A neutral solution containing $\not< 0·01\%$ MgO is pptd. with an excess of 0·1N-$Ba(OH)_2$ and boiled. 0·1N-$ZnSO_4$ solution is then added and the excess of $ZnSO_4$ titrated with 0·1N-$Ba(OH)_2$ solution (thymolphthalein indicator).   S. C.

Polarographic analysis of magnesium-rich alloys.—See B., 1939, 391.

Determination of magnesia and lime in cooking salt.—See B., 1939, 373.

Pyknometric determination of lead as sulphate. W. W. RUSSELL and J. H. A. HARLEY, jun. (Ind. Eng. Chem. [Anal.], 1939, **11**, 140—141).—The pyknometric method of analysis described previously (A., 1938, I, 95) has been successfully applied to the determination of Pb as $PbSO_4$ in non-ferrous alloys. With alloys containing 9·74% and 78·87% of Pb, the relative errors were 0·10 and 0·20%, respectively. For $PbSO_4$ and other dense ppts. centrifuging is unnecessary.   L. S. T.

Investigation of precipitation processes, in which bismuth and lead ions take part, by means of the corresponding radioactive isotopes. B. SAGORTSCHEV (Z. anal. Chem., 1939, **116**, 21—29). —The behaviour of $Pb^{\cdot\cdot}$ in pptns. of sparingly-sol. Bi compounds and of $Bi^{\cdot\cdot\cdot}$ in pptns. of insol. Pb compounds has been investigated by means of Th-B and Th-C. Pptn. of $Pb^{\cdot\cdot}$ as $PbSO_4$ is incomplete even in 0·01N-HCl, and in presence of $Bi^{\cdot\cdot\cdot}$, hydrolysis is complete with low [HCl] and high temp. Pptn. of $Pb^{\cdot\cdot}$ as $PbCrO_4$ is complete in [HCl] $\not> 0·1$N., but weighable amounts of $Bi^{\cdot\cdot\cdot}$ interfere with completeness of pptn. Weighable amounts of Pb interfere with the hydrolysis of $Bi^{\cdot\cdot\cdot}$. Pptn. of BiS is complete even in 1·5N-HCl. The adsorption effects which occur in these pptns. are discussed.   L. S. T.

Iodometric determination of copper. Selection of a suitable buffer solution. W. R. CROWELL (Ind. Eng. Chem. [Anal.], 1939, **11**, 159—161; cf. A., 1938, I, 271).—The equilibrium between KI, $CuSO_4$, and certain buffer solutions at 25° has been investi-

gated. In buffer solutions of HCO_2H, PrOH, and HF, Cu^{II} complexes similar to those obtained in buffer solutions of AcOH appear to be formed. The lowering of the % reduction of Cu at a given initial concn. of $Cu^{\cdot\cdot}$, I', salt, and acid depends approx. on the K of the acid, but this lowering is governed not so much by p_{H} as by the concns. of acid and salt. In the iodometric determination of Cu in presence of Fe and As at [Cu] and [I'] usually employed, satisfactory end-points in buffer solutions of these acids with a p_{H} between 3·2 and 4·0 can be obtained without the use of CNS' (cf. A., 1935, 837) when max. concns. of the salt of the acid are $\not> 0·1$—0·2M., 0·6—0·7M., and 1·0—1·6M. for acetate and propionate, formate, and fluoride, respectively. When Fe is present alone or with As, NH_4HF_2 solutions are preferable, and in Fe-free solutions containing As or in solutions free from Fe and As, HCO_2H is preferable to AcOH and PrOH. Results obtained for Cu without the use of CNS' in HCO_2H buffers containing As but no Fe show the same accuracy and precision as those obtained with addition of CNS'. When CNS' is not used in the analysis, the $Na_2S_2O_3$ should be standardised against metallic Cu.
                                L. S. T.

Separation of copper and zinc with sodium thiosulphate in the analysis of brass.—See B., 1939, 389.

Iodohydrargyrometry. D. M. QUINTELA (Rev. Soc. Brasil. Quím., 1938, **7**, 195—200).—In the titration of $HgCl_2$ with KI, the correction formula $N = 1·1063n - 0·454$ (n burette reading, N corr. val.) may replace Denigès' corrections.   F. R. G.

Conductometric studies. I. Mercuric chloride and sodium thiosulphate in conductometric analysis. J. KAMECKI (Rocz. Chem., 1938, **18**, 585—599).—Discrepant results are obtained in conductometric titration of $HgCl_2$ with $Na_2S_2O_3$ at room temp., whilst at 50° the results agree within 1%. The reaction is : $3HgCl_2 + 2Na_2S_2O_3 + 2H_2O \rightarrow Hg_3S_2Cl_2 + 2H_2SO_4 + 4NaCl$, which also holds at room temp., when $Na_2S_2O_3$ is added to excess of $HgCl_2$; the $[Na_2S_2O_3]$ is then determined by NaOH titration of the H_2SO_4 formed. In alkaline solution the reaction $HgO + 2Na_2S_2O_3 + H_2O \rightarrow Na_2[Hg(S_2O_3)_2]$ (I) + 2NaOH is quant. at room temp., and may be followed conductometrically. Two breaks are obtained in the titration curve of $Na_2S_2O_3$ by $HgCl_2$ (at 50°), corresponding probably with $4Na_2S_2O_3 + 2HgCl_2 \rightarrow 2(I) + 4NaCl$ and $2(I) + 3HgCl_2 + 4H_2O \rightarrow Hg_5S_4Cl_2 + 4H_2SO_4 + 4NaCl$.   R. T.

Volumetric determination of aluminium using sodium citrate. A. C. TITUS and M. C. CANNON (Ind. Eng. Chem. [Anal.], 1939, **11**, 137—140).—The free acid in the solution is neutralised with NaOH [amount required found by titrating an aliquot with NaOH to phenolphthalein (I)], and then heated to the b.p. with aq. Na citrate. When cold, the acid liberated is titrated with NaOH [(I) + thymolphthalein]. The [Al] is calc. from empirical equations. The method is applicable to solutions containing 150—810 mg. Al_2O_3 in absence of Fe.   L. S. T.

Precipitation of manganese as crystalline sulphide, by means of hydrogen sulphide in

presence of hexamethylenetetramine. E. A. OSTROUMOV (Zavod. Lab., 1938, 7, 1233—1237).— 100 ml. of slightly acid aq. Mn^{II} salt containing 2 g. of $(CH_2)_6N_4$ and filter-paper pulp are saturated with H_2S (15 min. at 60°, then 15 min. at 100°, cooling to room temp. without interruption of H_2S), and the ppt. of cryst. MnS is collected, washed with slightly alkaline 3% NH_4NO_3, dried, and ignited. The Mn oxides are dissolved in HCl, and Mn is determined by the usual methods; Ca, Mg, Na, and K do not interfere. Alkali and alkaline-earth metals are determined in the filtrate from MnS, which is evaporated to dryness with HNO_3–H_2SO_4, and the residue is ignited, and weighed as sulphate.   R. T.

Micro-determination of manganese in wine.— See B., 1939, 424.

Use of the persulphate method for determination of manganese in minerals, slags, and ferromanganese.—See B., 1939, 387.

Photometric micro-determination of iron. K. SHINOHARA (J. Biochem. Japan, 1939, 29, 57—79). —The material is ashed or digested with H_2SO_4– $HClO_4$ and treated to give a solution 0·05N. in HCl or H_2SO_4 and 0·34N. in HNO_3; if P_2O_7'''' is present, the solution is heated at 100° for 30 min. The solution (8 c.c.) is treated with 5M-KCNS (2 c.c.) and shaken for 20 sec. with iso-C_5H_{11}·OH (5 c.c.); the extinction coeff. of the alcohol layer is then determined within 5 min. The application of the method to yeast and water is described.   F. O. H.

Quantitative separation of iron from copper and manganese and the determination of these elements. P. SPACU and M. NICULESCU (Z. anal. Chem., 1939, 116, 119—123).—Fe is separated as Fe_2O_3,nH_2O from $Cu^{..}$ and $Mn^{..}$ by a double pptn. with C_5H_5N (cf. A., 1936, 952), the Cu is pptd. in the combined filtrates as $Cu(C_5H_5N)_4Cr_2O_7$ (A., 1939, I, 218), and then the Mn as $MnNH_4PO_4,H_2O$ (A., 1931, 453) by double pptn. to free it from CrO_4''. Test data are recorded. The method is suitable for Mn–Fe–Cu alloys, and is quicker than those usually employed.   L. S. T.

Deterioration of ferrous sulphate and ascorbic acid solutions. H. W. TOMSKI and L. S. WALLER (Pharm. J., 1939, 142, 239—241).—Solutions of $FeSO_4$ in dil. H_2SO_4 and other acids deteriorate about 1% per week; after the addition of glucose 0·6—0·8% per week. The rate of deterioration of ascorbic acid solutions inversely $\propto$ concn. 4 mg. per 100 c.c. disappeared completely in 3½ hr., 800 mg. per 100 c.c. in 30 days. Deterioration in urine was slower than in H_2O.   C. A. K.

Centigram (semi-micro-)analysis of minerals. VI. Determination of iron, sulphur, and copper in chalcopyrite. W. JANCZAK (Rocz. Chem., 1938, 18, 563—566).—An economy of 90% in reagents, and of 70% in time, is claimed for the eg., as compared with the ordinary, method.   R. T.

Volumetric analysis by means of thiocarbamide. I. Titration of chromates in presence of interfering elements. C. MAHR and H. OHLE (Angew. Chem., 1939, 52, 238—239).—Chromates, acidified with H_2SO_4 and in presence of KI and starch,

are titrated with 0·1N-$CS(NH_2)_2$ until the blue I–starch colour persists. Details of the method, which is applicable in presence of small amounts of Mo, V, W, Fe, Ni, Co, Zn, Mn, Al, Cd, Bi, Pb, Cl′, SO_4'', and ClO_4', are given. ClO_3', NO_3', S_2O_8'', CN′, CNS′, and $H_2C_2O_4$ interfere with the method.   C. R. H.

Retention of alkalis by the metal hydroxides of the chromium group. P. N. RAIKOV (Z. anal. Chem., 1939, 116, 39—40).—As in the case of NH_3 (A., 1938, I, 98), the Na retained when $Cr^{...}$ is pptd. with NaOH is chemically combined with partly-dehydrated Cr hydroxide to form a sparingly-sol. compound of the type $OH·Cr_2O_2(Cr_2O_3)_n·ONa$. On treatment with aq. NH_4Cl the Na is replaced by NH_4 giving the corresponding NH_4 compound, which liberates NH_3 with CO_2.   L. S. T.

Determination of chromium in aluminium.— See B., 1939, 391.

Potentiometric analysis of ferrochrome, of chromium, iron, and molybdenum in a sample, and of chromium–molybdenum steel.—See B., 1939, 388.

Potentiometric analysis of ferromolybdenum. —See B., 1939, 388.

Gravimetric determination of zirconium by means of sodium p-aminophenylarsinate (atoxyl). R. CHANDELLE (Bull. Soc. chim. Belg., 1939, 48, 12—32; cf. A., 1938, I, 327).—In 0·5N-HCl, $Zr^{....}$ gives a voluminous, white ppt. with atoxyl (I). The limiting sensitivity, 0·75 µg. of Zr, is little affected by the presence of excess of Fe, $Zn^{..}$, $Cr^{...}$, $Ni^{..}$, $Co^{..}$, $Mn^{..}$, $Al^{...}$, $Cu^{..}$, $Ca^{..}$ or $Mg^{..}$. Pptn. of Zr is complete in HCl of concn. $\gg$ N., and can be used for the gravimetric determination of Zr. The ppt. is washed with 0·5N-HCl and H_2O, and then converted into ZrO_2 as described previously (A., 1937, I, 634) for the corresponding methylarsinate. Data showing that the separation from Zn, Mn, Cr, Ni and Co, Al, Cu, or Ca and Mg is quant. are recorded, and applications to Cu–Zr and Al–Zr alloys, and Fe–Zr, are described. In presence of Ti, Zr is pptd. by NH_3 in presence of H_2O_2 before the pptn. with (I), and small amounts of Ti in the ignited ZrO_2 must be corr. for colorimetrically. $Fe^{...}$ must first be removed by extraction with Et_2O, and the ZrO_2 corr. for its Fe content. Under certain conditions, a compound of (I)–Fe–Zr appears to be formed.   L. S. T.

Electrolytic determination and separation of bismuth. I. Determination and separation in chloride solution. F. G. KNY-JONES (Analyst, 1939, 64, 172—175).—Using Pt gauze electrode and either Lindsey and Sand's $HgCl_2$ auxiliary electrode (A., 1934, 620) or Brown's wire electrode (A., 1926, 483) Bi is deposited from Cl′ solution provided that $H_2C_2O_4$ is added to the electrolyte. Bi may also be determined in presence of Pb and Sn and therefore in ternary alloys of the three metals.   E. C. S.

Volumetric determination of iridium in presence of Co^{II}, Ni^{II}, Cr^{III}, and Bi^{III}. A. A. GRÜNBERG and N. N. KATZ (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 941—947).—Ir^{III} present as $[IrCl_6]'''$ may be titrated with $KMnO_4$, and Ir^{IV} present as

[IrCl$_6$]'' with Fe^{II}. From the redox potentials the latter titration should give slightly low results. The accuracy of both titrations is markedly influenced by the presence of salts of Co^{II}, Ni^{II}, Cr^{III}, and Bi^{III}. F. J. G.

Application of organic redox systems to chemical analysis. V. Detection of traces of osmic acid. L. KULBERG (J. Gen. Chem. Russ., 1938, **8**, 1139—1142).—0·8 ml. of acetate buffer at p_H 4 and 0·1 ml. of reagent are heated for 15 min. with 0·1 ml. of the solution being tested. The min. detectable amounts of OsO$_4$ are as follows, with different reagents : leuconitrobrilliant-green 5, leucomalachite-green 0·5, leuconitromalachite-green (all 0·1% in 5% H$_2$SO$_4$) 0·03, 1% benzidine in EtOH 1, 1% o-tolidine in EtOH 0·003, 0·05% p-C$_6$H$_4$(NMe$_2$)$_2$ in COMe$_2$ 0·005, and 0·2% phenolphthalein in EtOH 0·002 μg. R. T.

Thermostat. T. H. LABY and V. D. HOPPER (Nature, 1939, **143**, 240).—An electrical arrangement for keeping apparatus at a const. temp. within 0·002°, without the necessity of insulation or surrounding with a circulating liquid, is described and illustrated. L. S. T.

Stroboscopic revolution counter for calorimeters. M. P. MICHEEV (Zavod. Lab., 1938, **7**, 1319).—A device for measuring rate of stirring is described. R. T.

New method for determining specific heats at extremely low temperatures. H. B. G. CASIMIR, W. J. DE HAAS, and D. DE KLERK (Physica, 1939, **6**, 255—261).—The difficulty of supplying a known quantity of heat to a paramagnetic salt to give a homogeneous temp. distribution can be overcome by making use of the hysteresis of the salt. Preliminary data are recorded for Fe NH$_4$ alum. L. J. J.

Fillings for the sheaths of mercury-in-steel thermometers. R. P. DONNELLY (Chem. and Ind., 1939, 285).—If the use of Hg is impracticable, a paste of 3 parts of graphite in 2 of lubricating oil is very satisfactory. D. F. R.

Sensitivity threshold of a gas radiometer. K. VULFSON (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 224—227).—Theoretical. A gas radiometer, of no matter what design, cannot attain the sensitivity claimed by Hayes (Rev. Sci. Instr., 1936, [ii], **7**, 202). A. J. M.

Sensitivity threshold of a gas radiometer. M. L. VEINGEROV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 228).—An error in calculation in a previous paper (cf. A., 1937, I, 151) is acknowledged. A. J. M.

Lithium fluoride–quartz achromatic lenses. D. C. STOCKBARGER and C. H. CARTWRIGHT (J. Opt. Soc. Amer., 1939, **29**, 29—31).—The optical consts. of LiF are compared with those of fluorite and quartz, and it is shown that quartz–LiF–quartz triplets can be used as achromatic combinations between λλ 1800—14,000 A. F. J. L.

Achromatic lenses employing lithium fluoride and fused quartz. B. K. JOHNSON (Nature, 1939, **143**, 376).—The val. of synthetic cryst. LiF as optical material is emphasised. A lens system combining LiF and fused quartz and giving complete achromatism over the range 5461—2749 A. has been designed. L. S. T.

Photo-electric nephelometer for chemical analysis. B. N. SINGH and N. K. A. RAO (Proc. Indian Acad. Sci., 1939, **9**, A, 78—85).—Constructional and operational details are given of a new type of nephelometer which has an accuracy of ±2·4%. Several applications of the apparatus are described. W. R. A.

Simple method of preparing X-ray photomicrographs of polished surfaces, using a camera obscura. L. V. ALTSCHULER and V. A. TZUKERMAN (Zavod. Lab., 1938, **7**, 1279—1283).—Apparatus is described. R. T.

Colour temperature–candlepower characteristic of tungsten lamps. K. S. WEAVER and H. E. HUSSONG (J. Opt. Soc. Amer., 1939, **29**, 16—19).—The form of the c.p.–colour temp. relation of W lamps is independent of size and construction; the average relation for 20 different lamps is given by $\log_{10}$ c.p. = $A - 13,000/T + 2.061 \times 10^6/T^2$ (A is a const. depending on the size of the source). Exponential forms are useful in studying changes in lamp characteristics with temp., and are of the form c.p.$_{·1}$/c.p.$_{·2}$ = $10^{11,350(1/T_2 - 1/T_1)}$. F. J. L.

Measurement of activation and decay of luminescent zinc silicate. N. C. BEESE (J. Opt. Soc. Amer., 1939, **29**, 26—28).—A transmission phosphoroscope consisting of a glass cylinder, which can be rotated at various speeds, and coated on the outside with a uniform layer of the luminescent material, is illuminated by a window lamp with light of λ 2537 A. The phosphorescent light is measured with a small Cs photo-cell placed in the cylinder and as near to it as possible. Activation of Zn silicate (willemite) is complete in 0·01 sec., and the time of decay is $<10^{-5}$ sec. for the fluorescence component which contributes $\frac{2}{3}$ of the luminescence. F. J. L.

Principles of cryoscopy and construction of a cryoscopic apparatus. Y. DOUCET (Compt. rend., 1939, **208**, 577—579).—In the apparatus described the difference of the equilibrium temp. of large amounts of ice in contact with the solution and with H$_2$O is measured with a thermocouple. Concns. are determined interferometrically. A. J. E. W.

Measurement of current density. B. N. KABANOV (J. Appl. Chem. Russ., 1938, **11**, 1424—1425).—A method is described. R. T.

Simple hydrogen electrode outfit. W. H. HALL (Ind. Eng. Chem. [Anal.], 1939, **11**, 158).—The apparatus described and illustrated is suitable for the accurate determination of [H˙] of buffer solutions. L. S. T.

Glass electrodes. M. DÉRIBÉRÉ (Bull. Assoc. Chim. Sucr., 1938, **55**, 3—26).—The glass electrode gives p_H vals. of high precision over a very wide range, as it is unaffected by strong acids or by oxidising or reducing agents. J. H. L.

Use of the glass electrode at temperatures up to 100°. R. G. HUMPHREYS (Chem. and Ind., 1939, 281—282).—For work at 100° a smaller and more robust glass bulb is attached permanently to the flask

containing the liquid to be examined. The connexion from the bulb to the HgCl half-cell is made through a long tube so that the liquid junction may be kept at room temp. The side arms of the half-cells are filled with agar–KCl jelly, which keeps for several months. An electrometer valve potentiometer is used. Calibration is effected by means of phosphate buffers. The glass electrode deviates from the H_2 electrode at elevated temp. and a calibration curve must be made, the cell being maintained at 100° for 48 hr. to ensure const. results.   D. F. R.

Apparatus for the determination of hydrogen ion. W. J. PULLAR (Pharm. J., 1939, **142**, 384).— The apparatus, which is inexpensive and is accurate to 0·002 unit, consists of a HgCl half-cell and glass electrode, a metre bridge, a valve millivoltmeter, and a null-point indicator.   L. S. T.

Counter tube investigations with a coincidence amplifier of variable resolving power. E. WEBER (Naturwiss., 1939, **27**, 134).—Apparatus is described for amplifying coincidences so that a resolving power for double coincidences of 10^{-4}–10^{-7} sec. is attained. Counter tubes filled with different substances have a max. possible resolving power dependent on the size and filling of the counter. The most important advantage of the amplifier is the fact that the resolving power is a const. of the amplifier alone.   A. J. M.

Scaling circuits in recording random counts. H. LIFSCHUTZ and O. S. DUFFENDACK (Physical Rev., 1939, [ii], **55**, 412—413).—The function of a scaling circuit in changing the random distribution of pulses into one in which the time intervals between pulses are more nearly equal, before feeding the pulses to the mechanical recorder, is of great importance for the reduction of the counting losses in the mechanical recorder. This is discussed, and illustrated by numerical data.   N. M. B.

Electric counter for thin-section analysis. C. S. HURLBUT, jun. (Amer. J. Sci., 1939, **237**, 253— 261).—In the counter described, six minerals can be measured and recorded at one time by the Rosiwal method. The time taken is < half that required by other methods of micrometric measurement. Measurements of the plagioclase, quartz, biotite, and hornblende in a tonalite from Elsinore, California, are given in illustration of the method.   L. S. T.

Automatic measuring device for liquids. RITTERHOFF (Chem.-Ztg., 1939, **63**, 217).—An automatic pipette with stop-cock and vac. filling for measuring out all types of liquids in routine analyses is described and illustrated.   L. S. T.

Simplified combustion pipette. G. H. NELSON, H. D. WEIHE, and D. F. J. LYNCH (Ind. Eng. Chem. [Anal.], 1939, **11**, 169—170).—A modification of the usual type of slow-combustion pipette for the analysis of mixtures of hydrocarbons and N_2 is described and illustrated. The Pt heating coil is located in a tube of comparatively small area and can be easily removed and replaced. 0·91—2·67% of CH_4 is left after 4 passages of this gas + O_2 over the Pt spiral.
L. S. T.

Improved gas analysis apparatus employing a simplified automatic absorption pipette. C. M.

BLAIR and J. H. PURSE (Ind. Eng. Chem. [Anal.], 1939, **11**, 166—168).—In the apparatus described and illustrated the absorbent is sprayed through the gas until absorption is complete by means of a push–pull air pump. With alkaline pyrogallol as absorbent the O_2 in 100 c.c. can be removed completely in 2 min. No attention is required during absorption, and reagents which hitherto have been regarded as too slow in their action can be used.   L. S. T.

Density determination in small amounts of liquid with the micro-buoyancy balance. E. EIGENBERGER (Mikrochem., 1939, **26**, 264—272).— The apparatus comprises a small pipette on the inner wall of which is fused a glass thread serving as a spring balance and carrying a hollow horizontal float containing a small Fe granule which serves as a rider. The balance is adjusted to the zero position in the liquid under test by movement of the rider. The position of the latter is determined either by adjusting it with an a.c. magnet operated by a micrometer screw, or by visual observation. Calibration is effected with liquids of known d. The apparatus is suitable for use with volatile liquids and for consecutive measurements on flowing liquids, e.g., during fractional vac. distillation.   J. W. S.

Universal potash bulb. V. M. GALAK (Zavod. Lab., 1938, **7**, 1316—1317).   R. T.

Wash-bottle. V. M. GALAK (Zavod. Lab., 1938, **7**, 1438—1440).   R. T.

Viscosimeter. M. G. SCHICHER (Zavod. Lab., 1938, **7**, 1440).   R. T.

Use of a new drop-test plate for examination under extreme conditions of p_H and r_H. M. DÉRIBÉRÉ (Ann. Chim. Analyt., 1939, [iii], **21**, 63—66).—The plate contains 9 holes in which the behaviour of a drop of solution can be examined under 9 combinations of conditions of acidity, alkalinity, neutrality, reduction, and oxidation. Examination under these conditions in daylight and under ultraviolet light frequently gives colours etc. which serve for identification. The behaviour of methylene-blue, fuchsin, rhodamines, flavin, naphthionic acid, etc. is described.   L. S. T.

Apparatus for rapid and accurate determination of low osmotic pressures. J. BOURDILLON (J. Biol. Chem., 1939, **127**, 617—625).—With the apparatus described, Π of 0·2 c.c. of protein solution can be determined in ≯8 hr. at room temp. without having to correct for sp. gr. and capillarity or determine the final concn. of the solution. The mol. wt. of hæmoglobin determined in 0·186% solutions in M./30 Sörensen's phosphate buffer at p_H 6·8 at 21° was 71,000 as compared with 68,000, the accepted val. in these conditions.   F. H.

Clerici solution for the determination of specific gravity of small mineral grains. R. H. JAHNS (Amer. Min., 1939, **24**, 116—122).—Advantages of the use of this solution are described. The ρ–η curve at 21° for a solution containing equal parts of Tl formate and malonate is linear. Curves showing the effect of temp. on η and on ρ are also reproduced. The method outlined for the determination of the ρ

of separate grains is almost as accurate as and quicker than pyknometric methods.   L. S. T.

Dialysis through cellulose membranes. W. NOWATKE (Rocz. Chem., 1939, **19**, 135—141).—The permeability of viscose cellulose membranes of the type of Cellophane has been determined.   R. T.

[Apparatus for] purification of mercury.—See B., 1939, 390.

Increasing the portability of the Bausch and Lomb dust counter. L. SILVERMAN and C. R. WILLIAMS (J. Ind. Hyg., 1939, **21**, 67—71).—A modification of the Bausch and Lomb dust counter (B., 1938, 594) is described, making the instrument smaller and more compact, without altering its efficiency. The case is fitted with a lighting outfit for counting in the field.   E. M. K.

High-speed centrifuging. J. W. BEAMS (Rev. Mod. Physics, 1938, **10**, 245—263).—A review dealing with the experimental technique of the Svedberg, air-driven, vac. type air-driven, steam and electrically driven, tubular vac. type, and the axially magnetic suspended centrifuges. The theory of sedimentation in ideal dil. solutions is also discussed. The applications of centrifuging to the determination of the mol. wts. of proteins and other compounds of high mol. wt., the concn. and purification of biological material, and the study of the living cell are described. The separation of gases and vapours by the centrifuge is also considered from the theoretical and practical points of view.   A. J. M.

Apparatus for producing drops of exactly equal size. L. HANSEN and K. WÜLFERT (Biochem. Z., 1939, **300**, 328—330).—A simple apparatus somewhat similar to the Rehberg micro-burette is described.   W. McC.

Over-pressures in ebulliometers. A. ZMACZYŃSKI (Rocz. Chem., 1938, **18**, 920—923).—Over-pressures need not be taken into account except for direct measurements, and even then only when the accuracy of temp. measurement is $> 0.001°$.   R. T.

Siphon with indicating meniscus and strengthened inlet and outlet arms. ANON. (Chem.-Ztg., 1939, **63**, 161).—The siphon is of glass and the outlet arm is double-walled; the jacket so formed communicates with the siphon tube just above the outlet cock so that the meniscus in the jacket shows the level of the liquid. The curve of the other arm is also double-walled for strength.   A. B. M.

Separation of liquid mixtures by combined thermo-diffusion and thermo-siphon action. H. KORSCHING and K. WIRTZ (Naturwiss., 1939, **27**, 110).—The method previously described (Clusius *et al.*, A., 1938, I, 539) has been applied to the separation of mixtures of C_6H_{14} and CCl_4, and of C_6H_6 and PhCl. An electrically heated wire or a Cu tube heated with oil was used as the hot surface, and a glass tube as the cold surface. The extent of separation under different conditions was investigated. The method may give rise to the more quant. investigation of the combined action of thermal diffusion and thermal siphon action, making it possible to determine the coeff. of thermal diffusion for liquids.   A. J. M.

Performance of gravimetric analyses by direct precipitation in Jena filter crucibles. G. G. LONGINESCU (Rocz. Chem., 1938, **18**, 688—690).—The ppt. is pptd., washed, dried, and weighed in the same sintered glass crucible.   R. T.

Arrangement for dissolution of small amounts of substance in the hot at constant volume. H. BALLCZO (Mikrochem., 1939, **26**, 252—254).—The lower portion of a micro-crucible is heated on a water-bath whilst the upper part is cooled by a metal coil wound around the outside of the crucible. Cooling-H_2O is fed to the coil through a const.-pressure device. Substances, *e.g.*, crusts of salts or ppts., adhering to the walls of the crucible can be dissolved in 10—20 min. in a definite vol. of liquid, or solutions can be warmed for a long time without change in vol.   J. W. S.

Device for washing precipitates with the filtrate. H. BALLCZO (Mikrochem., 1939, **26**, 250—251).—The filtrate receiver of a vac. filtration apparatus is constricted and graduated at the lower end, which terminates in a tap. The receiver is connected to the vac. pump through a three-way tap to simplify the admission of air to the vessel and removal of filtrate through the lower tap. The solution under filtration is fed to the filter by suction. The apparatus can be used on both macro- and micro-scales for washing ppts. with the filtrate, and also permits the use of exact amounts of washing liquids.   J. W. S.

Use of silica cotton in filter crucibles. W. W. RUSSELL and J. H. A. HARLEY, jun. (Ind. Eng. Chem. [Anal.], 1939, **11**, 168).—SiO_2 cotton is a suitable material for the filtering mats in Gooch crucibles, and retains CuCNS, $PbSO_4$, AgBr, AgCl, and Ni dimethylglyoxime. It does not sinter below 800°, and is more resistant chemically and less hygroscopic than resistance glasses or asbestos. For a 20-ml. crucible only 50 mg. are required. Gooch crucibles prepared with SiO_2 cotton have most of the advantages of a sintered-glass filter crucible, and can be used at higher temp.   L. S. T.

Apparatus with Jena glass filter discs for extraction, filtration, and gas-washing. P. H. PRAUSNITZ (Chem.-Ztg., 1939, **63**, 185—188).—Applications of the glass filter discs are described, and arrangements of apparatus for ordinary and automatic filtration, extraction of solids, gas-washing, and dispersion of gases in liquids are illustrated and discussed.   L. S. T.

Micro-separations by chromatographic adsorption on blotting paper. W. G. BROWN (Nature, 1939, **143**, 377—378).—White blotting paper or filter-paper is placed between two pieces of plate glass, the upper of which has a hole at its centre. The test solution, followed by the developing solution, is introduced through this hole, when the components of the solution travel outward in concentric zones, which can be examined by suitable physical or chemical methods. The pigments of green leaves can be readily separated in this way from CS_2 solution and the same developing solvent. For $>$ a few mg. of substances the method is preferable to using a micro-Tswett column.   L. S. T.

Stirring arrangement for micro-analytical purposes. H. Ballczo (Mikrochem., 1939, **26**, 248—249).—The crucible is fixed in a glass tube, perforated towards the lower end and ending in a glass rod carrying vanes. The device is arranged in an outer vessel so that injection of water or gas causes rotation, stirring being effected by a fixed glass rod dipping into the crucible. Stirring is accompanied by cooling or heating according as cold H_2O, compressed air, or steam is used as motive power.   J. W. S.

Flask for efficient stirring. A. A. Morton (Ind. Eng. Chem. [Anal.], 1939, **11**, 170).—Vertical creases in the sides of a round-bottomed flask markedly increase the efficiency of agitation of any solids present and prevent the formation of belts or layers. Agitation of the solid or slurry increases as the velocity of rotation is increased.   L. S. T.

Life and work of Ernest Solvay. R. Etienne (Bull. Soc. chim., 1939, [v], **6**, 405—421).

Development of Stahl's phlogiston theory. P. Walden (Rocz. Chem., 1938, **18**, 870—881).—Historical.   R. T.

Geochemistry.

Instability of the ozone layer at sunrise and sunset and the problem of determination of the height of the ozone layer. I. Chvostikov and N. Erschova (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 659—662).—During the daytime O_3 is decomposed by solar rays according to $O_3 + h\nu \rightarrow O_2 + O$, leading to a temporary loss in the O_3 content of the atm. After sunset rays of frequency ν are absent and the reverse process therefore occurs with the production of O_3. This temporary loss of O_3 content between sunrise and sunset is discussed in connexion with the " Umkehr-Effekt " and the effect observed by Rodionov et al. (cf. A., 1938, I, 384).   W. R. A.

Western Pacific Ocean. I. Composition of oceanic salt. Y. Miyake (Bull. Chem. Soc. Japan, 1939, **14**, 29—35).—Quant. analyses of samples of oceanic salt from different parts of the W. Pacific Ocean near Japan give the following average composition : Cl', $55.35_9 \pm 0.03_3$; Br', 0.19 ; CO_3'', 0.20 ; SO_4'', $7.75_2 \pm 0.02_2$; $Ca^{..}$, $1.23_1 \pm 0.00_5$; $Mg^{..}$, $3.75_2 \pm 0.01_5$; $Na^{.}$, $30.46_8 \pm 0.09$; $K^{.}$, $1.05_7 \pm 0.03_7\%$. The vals. agree closely with those for salt from the E. Pacific and are similar to those for the world's average, $Na^{.}$ and $K^{.}$ being slightly lower while Cl' and $Mg^{..}$ are slightly higher. Fluorescein and starch were used as indicator in determining Cl' by $AgNO_3$.   F. H.

Biological survey of Okanagan lake, British Columbia. W. A. Clemens, D. S. Rawson, and J. L. McHugh (Fish. Res. Bd., Canada, Bull. 56, 1939, 70 pp.).—In physical and chemical features this lake is comparable with Lake Constance, Switzerland. Dissolved O_2 (data given) is plentiful from surface to bottom with $\sphericalangle 70\%$ saturation. Temp., $[O_2]$, and $[N_2]$ indicate a lake of extreme oligotrophic type. At the surface, p_H is 8.0—8.2, at 15 m., 7.9—8.0, and at 100 m., 7.8. An analysis of the surface H_2O is recorded. Temp., $[O_2]$, and p_H data for neighbouring smaller lakes are recorded.   L. S. T.

Oxidation–reduction potentials of lake waters and their ecological significance. G. E. Hutchinson, E. S. Deevey, jun., and (Miss) A. Wollack (Proc. Nat. Acad. Sci., 1939, **25**, 87—90).   O. D. S.

Composition of Perekop lakes.—See A., 1939, I, 265.

Radioactivity of sea-water. E. Föyn, B. Karlik, H. Pettersson, and E. Rona (Nature, 1939, **143**, 275—276).—U is a const. component of sea-water, varying in proportion to the total salinity. Ocean-water of 3.5% salinity contains $\sim 2 \times 10^{-9}$ g. of U per g. The [Ra] of water from the Baltic, the Kattegat, the Skagerak, and the fjords of Bohuslän at depths down to 600 m. varies between 0.3 and 0.2×10^{-12} g. per l. Measurements on the Ra conc. in plankton cells appear to negative the view that suspended matter is responsible for variations in [Ra] of the H_2O. The average val. of 0.07×10^{-12} g. per l. found from these measurements is supported by the [Ra] found in mollusc shells, in which the ratio Ra : Ca is 0.2×10^{-12} corresponding with a [Ra] in the H_2O of $< 0.1 \times 10^{-12}$ g. per l. This [Ra] is ~ 0.1 of the equilibrium amount of the above [U], and the apparent deficiency of Ra may be due to a more or less complete removal of ionium from sea-water by pptn. with Fe, especially in coastal waters. The [Th] of sea-water is <1 µg. per l. and probably $<$ half this amount.   L. S. T.

" Dadino vrelo," a sulphur-containing thermal spring at Tuheljske Toplice. A. Režek and L. Marić (Arh. Hemiju, 1939, **13**, 10—16).—Analytical data are recorded.   R. T.

Salinity of the waters of the Seine between Amfreville and Honfleur. B. Rajčevič (Compt. rend., 1939, **208**, 760—762).—The variations of salinity (0.03—0.6%) are illustrated graphically and discussed.   A. J. E. W.

Variations of salinity during a September day of the waters of the maritime Aulne at Trégarvan. C. Francis-Bœuf (Compt. rend., 1939, **208**, 762—764).—Variations with time and depth are correlated with geographical factors.   A. J. E. W.

Sediments of Crystal lake, an oligotrophic lake in Vilas Co., Wisconsin. W. H. Twenhofel and W. A. Broughton (Amer. J. Sci., 1939, **237**, 231—252).—The $[CaCO_3]$ of the lake H_2O is 0.8 p.p.m., and only traces of $MgCO_3$ are present. The sediments are composed of quartz sands <1 mm. in diameter with some felspar, mica, and basic minerals, diatoms, sponge spicules, and org. matter. The sands gradually change to muds rich in org. matter. The H_2O content of the sediments ranges from 35.76 to 94.95% and decreases with depth. The fat content sol. in Et_2O and $CHCl_3$ is low. Loss on ignition is high

and decreases with depth. The SiO_2 and Al_2O_3 contents of the total mud are high and increase with depth. Ca, Mg, and Fe are low. The lignin content of the org. matter is variable, and is ~ one half of the org. matter. The sediments show practically no inorg. stratification. Chemical and mechanical analyses are recorded. L. S. T.

Significance and nature of the cone of depression in ground-water bodies. C. V. THEIS (Econ. Geol., 1938, **33**, 889—902). L. S. T.

Soper, Oklahoma, meteorite. F. C. WOOD and C. A. MERRITT (Amer. Min., 1939, **24**, 59—61).—This meteorite is an ataxite with an unusually high schreibersite content. The analysis [S. G. ENGLISH] is Fe 90·89, Ni 6·21, P 2·23, Co 0·70, C 0·02, S 0·03, Al 0·10, Cl trace, insol. 0·07, total 100·25%; ρ 7·387. L. S. T.

Magnetite crystals from meteoric solutions. K. SPIROFF (Econ. Geol., 1938, **33**, 818—828).—Primary magnetite (I) crystals occur in vugs and as a filling between limonite and leached Fe-ore conglomerate found on the Mesabi Range, Minnesota. Associated minerals are marcasite, goethite, hæmatite, and siderite. Laboratory and field evidence indicates that (I) is pptd. from meteoric waters. L. S. T.

Widmanstätten structure of octahedral meteoric iron. S. W. J. SMITH and J. YOUNG (Nature, 1939, **143**, 384—385).—A summary of the results of X-ray investigation of taenite and kamacite in meteoric Ni–Fe alloys, and of the origin of the Widmanstätten structure in meteorites. L. S. T.

Meteoric falls in the U.S.S.R. I. S. ASTAPOVITSCH (Nature, 1939, **143**, 376—377).—The Kukschin (Ukraine) meteorite, wt. 2250 g., has the average composition SiO_2 39·96, FeO 46·23, Al_2O_3 1·75, MnO 0·053, Cr_2O_3 0·45, MgO 6·22, CaO 1·91, S 2·77, NiO 1·85, and TiO_2 0·018%. L. S. T.

Geology and chemistry. N. L. BOWEN (Science, 1939, **89**, 135—139).—An address. L. S. T.

Isomorphic substitutions in apatite. D. McCONNELL (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 87—88).—A reply to criticism (A., 1938, 1, 421) of the view that C replaces Ca in the apatite structure (ibid., 283). L. S. T.

Isomorphic substitutions in the apatite group. N. V. BELOV (Compt. rend. Acad. Sci., U.R.S.S., 1939, **22**, 89—92).—A crit. discussion of the views of McConnell and of Borneman-Starinkevitch (cf. preceding abstract), and of the structure of the apatites. L. S. T.

Britholith—a cerium silicate apatite. G. HÄGELE and F. MACHATSCHKI (Naturwiss., 1939, **27**, 132—133).—The formula of britholith may be expressed as $(Na_2Ca_7Ce_{11})(F,OH)_4[(SiO_4)_9(PO_4)_3]$. Its optical properties correspond with those of an apatite, and X-ray observations show that it is isomorphous with the latter, a, 9·61, c, 7·02 A. Replacement of P^{+5} by Si^{+4} and of Ca^{+2} by Ce^{+3} causes a slight extension of the crystal lattice of apatite. d calc. from composition and lattice consts. is 4·49; $d_{obs.}$ 4·446. A. J. M.

Bell River complex, N.W. Quebec. B. C. FREEMAN (J. Geol., 1939, **47**, 27—46).—A complex of basic rocks and the severe alteration, viz., serpentinisation, hornblendisation, and chloritisation, which it has undergone are described. L. S. T.

Metamorphic phenomena produced by gabbroic intrusion. C. A. LAMEY (J. Geol., 1939, **47**, 82—97).—The changes produced in the minerals of the Knife Lake slate by intrusion of the Duluth gabbro are described. The chief minerals produced are plagioclase, hypersthene, monoclinic pyroxenes, biotite, and hornblende. L. S. T.

Gratonite. Preliminary description of a new mineral from Cerro de Pasco, Peru. C. PALACHE and D. J. FISHER (Amer. Min., 1939, **24**, 136).—Gratonite, hexagonal, rhombohedral, $a : c = 1 : 0.4428$, hardness $2\frac{1}{2}$, ρ 6·22, dark grey, has the composition $Pb_9As_4S_{15}$. L. S. T.

Crystallography of veatchite. J. MURDOCH (Amer. Min., 1939, **24**, 130—135).—Veatchite from Lang, California (cf. A., 1938, I, 482), has $a : b : c = 0.163 : 1 : 0.998$, β 121° 02′. Crystallographic data for the 14 forms observed are recorded. L. S. T.

New occurrence of alurgite from California. R. W. WEBB (Amer. Min., 1939, **24**, 123—129).—An occurrence of the purple mica, alurgite (I), found previously only in Piedmont, in boulders on the Cajon Pass, California, is described. Physical properties and chemical analyses of (I) from the two localities are compared. The colour of (I) from California is due probably to TiO_2. L. S. T.

Composition, space-group, and unit cell of hanksite. L. S. RAMSDELL (Amer. Min., 1939, **24**, 109—115).—The composition, $9Na_2SO_4,2Na_2CO_3,KCl$, for hanksite (I) has been confirmed. X-Ray photographs give a_0 10·46, c 21·18 A.; space-group C_6^6—$(C6_3)$ or C_{6A}^2—$(C6_3/m)$, and 2 formula wts. per unit cell. Morphological evidence favours the second space-group. (I) may possess a superstructure based on 12 units of the high-temp. form of Na_2SO_4 with KCl occupying a definite position. L. S. T.

Sedimentary deposits of copper, vanadium–uranium, and silver in south western United States. H. G. RAGGATT (Econ. Geol., 1939, **34**, 113—115; cf. A., 1938, I, 587). L. S. T.

Volcanic centres of the Sunlight area, Park County, Wyoming. W. H. PARSONS (J. Geol., 1939, **47**, 1—26).—The volcanic history of this area is described. The rock types in general show a normal differentiation series from olivine gabbro and basalt through diorite and andesite to sodic syenite and trachyte. Several unusual orthoclase-bearing basalts, the absarokite series, are also present. Four new chemical analyses are recorded and discussed with 10 others. L. S. T.

Lead–zinc ore deposits and geology of the Arbus area in Sardinia, Italy. C. W. WRIGHT (Econ. Geol., 1939, **34**, 82—95).—The two systems of Pb–Zn veins are described. The one is rich in sphalerite and galena (I) and the other consists essentially of (I) altered to cerussite. Production and genesis of the ore are discussed. Chemical analyses of two schists, a hornfels, and a granite are recorded. L. S. T.

Nickel–cobalt–native silver ore type. E. S. BASTIN (Econ. Geol., 1939, **34**, 1—40).—The chief characteristics of the Ni–Co–Ag ore type as shown in different parts of the world are reviewed, and the minerals reported from all Ni–Co–Ag deposits are tabulated. Genetic relationships to sp. classes of igneous rocks are discussed. In most districts, derivation of the mineralising solutions from acid magmas, mainly granitic, is indicated. L. S. T.

Diaschistic dykes and ore deposits. J. E. SPURR (Econ. Geol., 1939, **34**, 41—48).—The close association between basic dykes and ore deposits is discussed. L. S. T.

Geology of the Bonanza King mine, Humboldt Range, Pershing Co., Nevada. D. F. CAMPBELL (Econ. Geol., 1939, **34**, 96—112).—The ore body is a quartz vein containing various sulphides, some of which carry Au and Ag. Primary minerals are quartz, pyrite, tetrahedrite, galena, sphalerite, chalcopyrite, and native Au. Secondary enrichment appears to have yielded covellite, chalcocite, stephanite, and argentite. The origin of the deposit is discussed. L. S. T.

Quartz-diorite from Glenduckie Hill, Fife. F. WALKER (Geol. Mag., 1939, **76**, 72—76).—The mineralogy and petrology of the diorite are described. A chemical analysis (N. SAHLBOM) is recorded and compared with other analyses of similar magma-type. L. S. T.

Teepleite, a new mineral from Borax Lake, California. W. A. GALE, W. F. FOSHAG, and M. VONSEN (Amer. Min., 1939, **24**, 48—52).—*Teepleite*, tetragonal, a_0 7·27, c_0 4·84 A., uniaxial, negative, ε 1·503, ω 1·519, ρ 2·076, hardness 3—3·5, occurs with halite and trona on specimens from this lake. The chemical analysis [W. F. FOSHAG] corresponds with $Na_2B_2O_4,2NaCl,4H_2O$. An analysis [F. H. MAY] of the Borax Lake brine is also recorded. L. S. T.

Kotoite, a new rock-forming magnesium borate. T. WATANABE (Tsch. Min. Petr. Mitt., 1939, **50**, 441—463; Fortschr. Min. Krist. Petr., 1939, **23**, clxvi—clxvii).—*Kotoite* occurs in large quantity (>1000 tons) as a granular constituent of dolomitic marble in the Hol Kol Au–Cu–Bi mine, Suan, Korea, where it has been formed, together with forsterite, clinohumite, spinel, fluoborite, etc., by the intrusion of granite into dolomite. It is orthorhombic with perfect (110) cleavage and (101) lamellar twinning; H 6½, ρ 3·11, α 1·652, β 1·653, γ 1·673, 2V 21°, positive; unit-cell dimensions a 5·41, b 8·42, c 4·51 A. Analysis gave B_2O_3 35·20, MgO 62·78, SiO_2 1·32, Al_2O_3 0·26, Fe_2O_3 0·20, FeO 0·61, CaO 0·18, H_2O+ 0·05 = 100·60%. These data are all in agreement with those for $Mg_3B_2O_6$, which is readily prepared by fusing together MgO and B_2O_3. Under hydrothermal conditions the mineral is altered to szaibelyite. In portions of the dolomite rich in Fe the metamorphic products are ludwigite and magnetite. Kotoite has also been found in the interior of nodules of szaibelyite from Rézbánya, Hungary (now Băița, Rumania). L. J. S.

Physicochemical investigation of borates. A. V. NIKOLAEV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 415—432).—Transitions in presence of H_2O and salt solutions of the borate minerals (inyoite, colemanite, pandermite, ascharite, inderite, ulexite, kaliborite, and hydroboracite) found in the Inderian deposits have been studied. Analyses and distributions of mineral samples from these deposits are recorded. L. J. J.

Petrography of the "Laacher trachyte." E. SCHAEFER (Tsch. Min. Petr. Mitt., 1939, **50**, 464—486).—These rocks are found only as ejected blocks in the trachyte-tuffs, and have been distinguished as "light" and "dark" trachytes. Chemical and micrometric analyses are given and the "dark" trachyte is now referred to latite. They are distinct from olivine-bearing haüyne-latite. L. J. S.

Formation of elastic twins during twinning of calcite crystals. R. I. GARBER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 229—231).—The mechanism of twinning of calcite crystals has been studied, especially in the stage which precedes the formation of common residual twins. Stresses as low as 26 g. per sq. mm. produce elastic twins. The size of the elastic twin is approx. $\propto$ applied load. A. J. M.

Geochemistry of the environs of Kislovodsk. A. E. FERSMAN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 242—245).—The processes giving rise to the formation of the Valanginian rocks of the Kislovodsk district are analysed. A list of minerals found in geodes and cavities in these rocks is given, and their bearing on the formation of the rocks is discussed. The sequence of crystallisation of the various minerals of the deposits is given. The connexion between the formation of the rocks and the composition and origin of the mineral waters of the district is discussed. A. J. M.

Sapphirine crystals from Blinkwater, Transvaal. E. D. MOUNTAIN (Min. Mag., 1939, **25**, 277—282).—Altered crystals, occurring with corundum in a granitic rock, gave on analysis (after deducting H_2O due to alteration) results agreeing approx. with the usually accepted $5MgO,6Al_2O_3,2SiO_2$, but rather more closely with $Mg_7Al_{18}Si_3O_{40}$. Goniometric measurements agree with a recalculation ($a : b : c = 0.6889 : 1 : 1.4056$, $\beta = 68°$ 33′) of previous vals. Optical data are given, and the optical orientation is corr. L. J. S.

Relation of stellerite and epidesmine to stilbite. A. PABST (Min. Mag., 1939, **25**, 271—276).—Chemical analysis of a stellerite-like mineral from California and previous analyses of stellerite, epidesmine, and stilbite agree with $Na_xCa_{2+y}Al_{4+x+2y}Si_{14-x-2y}O_{36},14H_2O$, with $x < 1$ and $-0.15 < y < 0.30$. These minerals also agree in their optical and X-ray data. They are pseudo-orthorhombic with cell dimensions a 13·60, b 18·13, c 11·29 A., β 52°. L. J. S.

Crystallography of sartorite. F. A. BANNISTER, A. PABST, and G. VAUX (Min. Mag., 1939, **25**, 264—270).—X-Ray photographs give cell dimensions a 58·38, b 7·79, c 83·30 A. with β 90°, containing 240 mols. $PbAs_2S_4$. An orthorhombic pseudo-cell with a 19·46, b 7·79, c 4·17 A. contains 4 mols. $PbAs_2S_4$.

These data are adjusted to previous goniometric measurements of the complex crystal-forms.   L. J. S.

Zoned olivines and their petrogenetic significance. S. I. TOMKEIEFF (Min. Mag., 1939, **25**, 229—251; Rep. Brit. Assoc., 1938, 418—419).—Measurements of the optic axial angle in a large no. of zoned olivines in various kinds of rocks show that the centre is richer in Mg and the margin richer in Fe. Olivine in olivine-rich rocks is richer in Mg than in olivine-poor rocks, and the olivines of the phenocrysts are richer in Mg than those of the groundmass.   L. J. S.

Classification of igneous rocks. S. I. TOMKEIEFF (Geol. Mag., 1939, **76**, 41—48).—Historical.   L. S. T.

Chemistry of ore solutions. O. C. SCHMEDEMAN (Econ. Geol., 1938, **33**, 785—817).—The assumptions and evidence on which the current alkaline theory of ore solutions is based are reviewed, and criticised in regard to certain types of wall rock alteration. Mineral deposits provide strong evidence that ore solutions are originally acid and continue so up to a point at which known ore deposits have been formed; they become neutral or alkaline only after long travel and recognisable reaction with their channelways. Chemical analyses illustrating quartz–sericite–orthoclase alterations, sericitisation at Bingham, Utah, sericitisation and propylitisation at Butte, Montana, tourmaline alteration, alunite and pyrophyllite alteration at Kyuquot Sound, B.C., kaolinisation, silicification at Bonanza, Colorado, alunitisation at Rosita Hills, Colorado, and at Goldfield, Nevada, are recorded and discussed.   L. S. T.

Pyrosynthesis, identification, and study of tin sulphides and of compounds of tin sulphides with antimony and lead sulphides. A. M. GAUDIN and W. T. HAMLYN (Econ. Geol., 1938, **33**, 868—888; A., 1938, I, 376).—These sulphides have been investigated by the method of iridescent filming, using principally a saturated solution of $AgNO_3$ in 50 vol.-% HNO_3. The colours given by the sulphides with this solution at 25° and with HCl–H_2CrO_4 solution are recorded, and provide a key for their identification. Sn and SnS are only partly sol. in the liquid state. A eutectic occurs between SnS and Sn_2S_3, but not between Sn_2S_3 and SnS_2. Sn_2S_3 appears to have an incongruent m.p. S is always the last phase to solidify. SnS_2 appears to decompose at between 575° and 625°. At temp. >500°, Sn sulphides form no compounds with PbS. Teallite, PbS,SnS or PbS,SnS_2, could not be synthesised; only solid solutions of SnS and Sn_2S_3 in PbS were obtained. With stibnite (I) SnS forms the compounds SnS,Sb_2S_3 and $3SnS,Sb_2S_3$, both of which have incongruent m.p. SnS_2 forms no compound with (I), but a characteristic *compound* of SnS,Sn_2S_3 and (I), probably $4SnS,Sn_2S_3,Sb_2S_3$, has been obtained. No natural minerals were obtained in this system. Phase diagrams for these systems are reproduced.   L. S. T.

Urals excursion and notes on the XVIIth International Geological Congress, Moscow, July–August 1937. E. SPENCER (Trans. Min. Geol. Met. Inst. India, 1938, **34**, 215—231).—The following are described briefly: the Saranovskoye chromite deposit, the Mt. Blagodat magnetite deposit, the Pt-bearing chromite of the Nizhny Tagil dunite massif, the chrysolite-asbestos deposits of Bezhenov, the Au-bearing quartz veins of Berezovsk, the Satka magnesite deposit, the Korkino coalfield, the Ni deposits of Orsk-Khalilovo, the Gumbeika scheelite, the Fe ore of Mt. Magnitaya, and the Fe and steel works of Magnitogorsk.   L. S. T.

Iron ores of the Bailadila range, Bastar State. H. CROOKSHANK (Trans. Min. Geol. Met. Inst. India, 1938, **34**, 253—281).—The geology and the ore deposits are described. Estimated reserves of ore are ≮610 × 10⁶ tons. Possible exploitation of the ores is discussed.   L. S. T.

Inesite. J. J. GLASS and W. T. SCHALLER (Amer. Min., 1939, **24**, 26—39).—Inesite (I) from Quinault, Washington, has α 1·616, β 1·641, and γ 1·652±0·001, and SiO_2 45·67, MnO 35·10, FeO 0·92, MgO 0·86, CaO 9·33, H_2O- 2·13, H_2O+ 6·53, Al_2O_3 0·0, PbO 0·0, total 100·54% [J. G. FAIRCHILD]. A spectrographic analysis [G. STEIGER] showed K and Sn present in small quantities, but Ba, Sr, Cs, Rb, Li, B, Ag, As, Bi, Pb, Sb, Zn, Be, Cd, Ge, and Tl absent. The optical properties (tabulated) of (I) from other localities are remarkably const., indicating a const. chemical composition for the mineral. Chemical analyses by different analysts of material from 6 different localities show only small variations in the % composition. Ca does not vary reciprocally with Mn as in rhodonite. The commonly-accepted formulæ for (I), $3SiO_2,3R^{II}O,2H_2O$, or $2SiO_2,2R^{II}O,H_2O$, are not supported by the analyses. The most probable formula is $15SiO_2,3CaO,11MnO,10H_2O$.   L. S. T.

Chemical similarity of idocrase and certain garnets. D. McCONNELL (Amer. Min., 1939, **24**, 62—63).—The non-volatile constituents of idocrase and garnets are represented on a triangular diagram compiled from chemical analyses recorded from 1909 to 1937. The chief difference is the relatively greater abundance of $(Ca,Mg,Mn,Fe,K_2,Na_2)O$ in idocrase.   L. S. T.

Formation of native lead under laboratory conditions. L. H. N. COOPER and D. P. WILSON (Nature, 1939, **143**, 207).—A lute composed of white lead, red lead, and linseed oil, exposed for 50 years to the action of sea-water rich in org. matter, shows reduction of the oxides and carbonates of Pb to PbS and, in some cases, to metallic Pb.   L. S. T.

Sulphotellurides of bismuth. J. GARRIDO and R. FEO (Bull. Soc. Franç. Min., 1938, **61**, 196—204).—X-Ray data obtained by the powder method are recorded for Bi, bismuthinite from Tazna, Bolivia, tetradymite, grünlingite from Ronghten Gill, Cumberland, oruetite from Serrania de Ronda, Malaga, and joséite from Brazil.   L. S. T.

Olivines from the Skaergaard intrusion, Kangerdlugssuak, East Greenland. W. A. DEER and L. R. WAGER (Amer. Min., 1939, **24**, 18—25).—Chemical analyses and optical data of four olivines separated from this intrusion are recorded and fitted into the Bowen–Schairer diagram (A., 1935, 447) for

synthetic olivines. The results show that in natural magmas, as in synthetic olivines, a complete series of solid solutions can occur. The classification and nomenclature of the olivine series are discussed.

L. S. T.

Accurate determination of the components of a heterogeneous particulate mineral system. F. H. GOLDMAN and J. M. DALLAVALLE (Amer. Min., 1939, 24, 40—47).—A method for obtaining the shape factor of a mineral, plotting the size distribution curve, and determining the wt.-% of any constituent from a particle count is described.

L. S. T.

Identity of hallerite and lithium muscovite. J. MALLET (Bull. Soc. Franç. Min., 1938, 61, 209—211).—The optical properties, ρ, and the chemical analysis now given show that hallerite should be regarded as a lithia muscovite containing traces of Cr.

L. S. T.

Leucite. J. WYART (Bull. Soc. Franç. Min., 1938, 61, 228—238; cf. A., 1937, I, 17; 1938, I, 105).

L. S. T.

Colour of artificial crystals of rock-salt. H. EKSTEIN (Bull. Soc. Franç. Min., 1938, 61, 239—244).—The pink coloration occasionally obtained in the prep. of these crystals by the method of Kyropoulos (A., 1926, 926) is due to the presence of metallic Na resulting from overheating of the fused NaCl.

L. S. T.

Dioritic massif from Brée-Neau, Mayenne. L. BERTHOIS (Bull. Soc. Franç. Min., 1938, 61, 214—227).—Chemical analyses of a quartz diorite and a granite are recorded and discussed.

L. S. T.

Formation and structure of Styrian graphites. O. FRIEDRICH (Berg- u. Hüttenm. Jahrb., 1936, 84, 131—137; Chem. Zentr., 1937, i, 814—815).—Graphitisation was preceded by disturbance of the strata, and followed by penetration of H_2O. Plant-like structures are comparatively frequent. The grain-size is very small, approaching colloidal magnitude.

A. J. E. W.

Succession of minerals and temperatures of formation in ore deposits of magmatic affiliations. W. LINDGREN (Amer. Inst. Min. Met. Eng., 1936, Tech. Publ. 713, 23 pp.).—A comprehensive summary of data relating to crystallisation temp. of minerals and to changes taking place subsequently.

CH. ABS. (e)

Barite deposits of Virginia. R. S. EDMUNDSON (Amer. Inst. Min. Met. Eng., 1936, Tech. Publ. 725, 17 pp.).—The deposits are described. CH. ABS. (e)

Bauxite deposits at Gánt, Hungary. Q. D. SINGEWALD (Econ. Geol. 1938, 33, 730—736).—Present workings are described. The ore contains Al_2O_3 50—63, Fe_2O_3 15—30, and SiO_2 2—4%. Reserves are estimated at 12×10^7 tons. L. S. T.

Sulphate minerals of the Comstock Lode, Nevada. C. MILTON and W. D. JOHNSTON, jun. (Econ. Geol. 1938, 33, 749—771).—17 representative samples of supergene sulphates occurring as incrustations, stalactites, etc. in the Comstock Lode are described. They range from simple minerals such as gypsum and epsomite (I) to complex aggregates of four or more species. All are known species

except a mineral of the Cu (chalcanthite) or Mg sulphate pentahydrate group which has approx. half the Mg replaced by Cu, Zn, Fe^{II}, and Mn. Chemical analyses of the (I), melanterite, goslarite, mixtures of pickeringite and (I), and of 8 mine waters are recorded.

L. S. T.

Gas bubbles as nuclei for " oolites." E. B. ECKEL (Science, 1939, 89, 37—38).—The formation of spherical coatings of $CaCO_3$ about gas bubbles in quiet and in slowly-moving H_2O from the Pinkerton hot springs is described, and discussed in relation to the formation of true oolites.

L. S. T.

Development of the volcanism of the " rotliegenden " formation in the Black Forest. R. WEYL (Z. deut. Geol. Ges., 1938, 90, 367—380).—Geological. 21 chemical analyses, mainly of quartz porphyries, are tabulated.

L. S. T.

Synthesis of orthoclase and albite by pneumatolysis using shattering explosives. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1939, 208, 293—294; cf. A., 1938, I, 207).—Cryst. specimens of the minerals have been obtained by detonation of mixtures of hexogen, SiO_2, Al_2O_3, and K_2CO_3 or Na_2CO_3 in A, followed by prolonged heating at 500—550°.

A. J. E. W.

Silicates. VIII. Thermal transformation of anthophyllite, $Mg_7Si_8O_{22}(OH)_2$. Polymorphism of magnesium metasilicate and the mechanism of the transformation of anthophyllite and talc on heating. E. THILO and G. ROGGE (Ber., 1939, 72, [B], 341—362).—The investigation of the thermal transformation of anthophyllite led to a study of the polymorphism of $MgSiO_3$. Enstatite, klinoenstatite, and the Haraldsen modification (Neues Jahrb. Min., 1930, 61, A, 139) of $MgSiO_3$, for which the name mesoenstatite is suggested, are stable enantiotropic modifications, the transition points being enstatite $\rightleftharpoons$ mesoenstatite approx. 900°, and mesoenstatite $\rightleftharpoons$ klinoenstatite approx. 1270°. The transformations are facilitated by the presence of LiF. In addition there are two metastable modifications, M_1 and M_2. M_1 is formed at approx. 950° on ignition of amorphous ppts. having $MgO : SiO_2 = 1 : 1$, and at higher temp. changes successively into M_2 and mesoenstatite. The X-ray diagrams of M_1 and M_2 are not very different from that of klinoenstatite, and in cases where the formation of the latter at low temp. has been reported M_1 or M_2 was probably formed. Anthophyllite when ignited loses SiO_2 and H_2O at 900°, affording enstatite according to $Mg_7Si_8O_{22}(OH)_2$ = $7MgSiO_3 + SiO_2 + H_2O$ without passing through an amorphous phase, whereas talc at 900° breaks up first into amorphous $MgO + SiO_2$ and then passes through M_1 and M_2 into mesoenstatite. The mechanism of the transformations is elucidated in terms of the lattice structures.

F. J. G.

Occurrence in Abyssinia of rare minerals required for the production of corrosion-resisting alloys. O. SCARPA (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 88—89; Chem. Zentr., 1937, i, 320).—Abyssinian pegmatites may contain utilisable quantities of Nb.

A. J. E. W.

Amethysts from Brandberg, German S.W. Africa. G. MENZER (Zentr. Min., 1936, A, 289—290; Chem. Zentr., 1937, i, 812).—The amethysts have an intense but non-uniform colour, and contain many solid and liquid inclusions. The crystals form Swiss law twins, and are pleochroic.   A. J. E. W.

X-Ray examination of chillagite. F. M. QUODLING and S. B. COHEN (J. Proc. Roy. Sci. New South Wales, 1938, 71, 453—546).—Crit. examination of crystallographic data and partial X-ray analyses indicate that chillagite is not a distinct mineral species.   H. W.

Labradorite-hyperoranite. S. S. GOLDICH and G. A. MUILENBURG (Amer. J. Sci., 1939, 237, 130—134; cf. A., 1933, 1137).—The large phenocrysts in the Mount Devon, Missouri, diabase porphyry represent labradorite that has been altered hydrothermally with the introduction of K to form sericite. The possible existence of oranite, an intergrowth of high-Ca plagioclase and a K felspar, is discussed.   L. S. T.

Dolomite and jasperoid in the Metalline District, N.E. Washington. C. F. PARK, jun. (Econ. Geol., 1938, 33, 709—729).—Jasperoid, cryst. dolomite, and, to a smaller extent, coarse-grained calcite are favourable but not infallible signs of the presence of nearby ore. The Metalline limestone was dolomitised regionally before the ore was introduced. Analyses of carbonate rock drill cores from this district are recorded graphically.   L. S. T.

Tarnowitzite and plumbocalcite. Mechanism of intergrowth in anomalous mixed crystals. H. SEIFERT (Z. Krist., 1938, 100, 120—127; cf. Siegl, A., 1938, I, 588).—A review of the at. structural and dynamic principles involved in anomalous intergrowth (cf. A., 1938, I, 439) is illustrated by reference to the combination of cerussite with calcite and with aragonite.   I. McA.

X-Ray methods of determination and investigation of lead stibnites. J. E. HILLER (Z. Krist., 1938, 100, 128—156; cf. Hofmann, A., 1933, 214, 1106).—Cell elements, ρ, and Z are determined for members of the $mPbS,nSb_2S_3$ series from indexed visual intensities of powder X-radiograms; these provide criteria of chemical and structural identity. Mineralogical relations are discussed.   I. McA.

Origin of tourmaline in sedimentary rocks. L. BERTHOIS (Compt. rend., 1939, 208, 207—209).—The occurrence of small unworn crystals of ferromagnesian tourmaline in sedimentary rocks is not in itself sufficient evidence of their genesis *in situ*.   A. J. E. W.

Composition of Finnish clays. A. SALMINEN (Suomen Kem., 1939, 12, A, 2—7).—A review. It is concluded that the majority of (Late Glacial) Finnish clays have been formed under marine conditions and are not in general formed by leaching out of the older laminated morainic clays.   M. H. M. A.

Origin of kaolin. P. A. ZEMIATCHENSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 471—473).—Certain transitional stages in the weathering of granite-gneisses to kaolin have been observed in the Ukraine. Chemical compositions and physical properties of samples are recorded and their significance is discussed.   J. A. K.

Clays and other minerals from the deep sea, hot springs, and weathered rocks. H. E. MERWIN and E. POSNJAK (Amer. J. Sci., 1938, [v], 35, A, 179—184).—Optical and X-ray investigations are described.   E. S. H.

Thorium–uranium ratios of rocks and their relation to lead ore genesis. N. B. KEEVIL (Econ. Geol., 1938, 33, 685—696).—Th-U ratios for a new series of numerous basaltic and granitic rocks from widely-separated localities are recorded. The average ratio for the former is 3·3, and for the latter 2·8. The at. wts. of rock leads calc. from these results show that the variation to be expected is 207·18—207·21, in agreement with recent isotopic analyses of a series of ore leads (cf. A., 1938, I, 426). The differences expected by Holmes (*ibid.*, 163) between the at. wts. of rock leads and ore leads are not substantiated. The vals. calc. by Holmes are too low. These results, together with Graton's crit. analysis (*ibid.*, 542), indicate that ore leads are derived, directly or indirectly, from basaltic or granitic rocks or their magmas, and not from some deeper magmatic source.   L. S. T.

Radium in rocks. V. Radium content of the four groups of pre-Cambrian granites of Finland. C. S. PIGGOT (Amer. J. Sci., 1938, [v], 35, A, 227—229).—Ra contents are tabulated.   E. S. H.

Radium and the petrology of certain granites of Finland. T. F. W. BARTH (Amer. J. Sci., 1938, [v], 35, A, 231—245).—No relation is found between Ra and K_2O or FeO, but for granite belonging to the same type the Ra content can be correlated with the amount of biotite.   E. S. H.

Late gold and some of its implications. O. H. ÖDMAN (Econ. Geol., 1938, 33, 772—775).—The occurrence of Au in relation to other minerals in the Au–Cu–As ore at Boliden and other examples indicates that the Au of each stage of ore deposition crystallised with the other ore and gangue minerals from a single, complex solution. Mawdsley's views (A., 1938, I, 333) are not supported.   L. S. T.

Occurrence of barium in coal. F. M. REYNOLDS (J.S.C.I., 1939, 58, 64—66).—Small but analytical amounts of Ba compounds are of frequent occurrence in coal. Of 25 coal ashes from three different districts, only two contained no Ba, the amount in most cases being >0·2% of BaO, and in one case nearly 5%. In a seam of high average content there may be wide variations in concn. in both vertical and lateral directions, and in a local region of high average content there may be wide variations among the different parts of the coal. Barytes was found in the cleavage-planes in thin, cryst. flakes, sometimes brownish-pink but more often colourless. The occurrence was apparently of extraneous origin, and the association of a high Ba content with a high Cl content, together with the presence of $BaCl_2$ in the associated mine-waters, suggest that it is the result of infiltration of solutions of $BaCl_2$.

Stark effect broadening of hydrogen lines. I. Single encounters. L. SPITZER, jun. (Physical Rev., 1939, [ii], **55**, 699—708).—Mathematical.
N. M. B.

Luminous zones at cathodes in glow discharges. H. SPORN (Z. Physik, 1939, **112**, 278—304).—A general and microphotometric examination of the conditions in the glow at cathodes coated with Li_2O, Na_2O, and MgO. L. G. G.

Structure of the Be I line λ **4573 A.** S. MROZOWSKI (Physical Rev., 1939, [ii], **55**, 798—799).—High-precision investigations do not support any asymmetrical structure of the 4573 A. line as reported by Parker (A., 1935, 1). The weak component of the Be II line 4673 A. found by Kruger (A., 1933, 1219) is probably due to a foreign line. N. M. B.

Isotope displacement in the boron spectrum. S. MROZOWSKI (Z. Physik, 1939, **112**, 223—233).—Both lines of the B I doublet 2497/8 A. show an asymmetry on the short-wave side due to a shift of the ^{11}B line by -0.17 cm.$^{-1}$, the intensity ratio in the doublet being 2.04 ± 0.08. The B II line shows two components separated by 0·877 cm.$^{-1}$ The sp. isotope displacements are -0.37 cm.$^{-1}$ (B I) and 0·734 cm.$^{-1}$ (B II), and the isotope concn. ^{11}B/^{10}B is 3.95 ± 0.01. L. G. G.

Band spectra in nitrogen at atmospheric pressure. Source of band spectra excitation. O. R. WULF and E. H. MELVIN (Physical Rev., 1939, [ii], **55**, 687—691).—The construction and action mechanism of a special type of ozoniser working at atm. pressure and room temp. for band spectra excitation are described. N_2 bands $A \to X$ were photographed in emission under resolution allowing measurement of rotational structure. Calc. and measured rotational data, tabulated for the (0—6), (0—5), (1—5), and (1—4) bands, are in satisfactory agreement. The characteristics of this source and of a high-current, low-voltage arc are compared. N. M. B.

Stark effects in the sodium arc spectrum. W. OLBERS (Ann. Physik, 1938, [v], **33**, 708—722).—The Stark effects of the terms $6P$ to $8P$, $5S$ to $8S$, and $4D$ to $8D$ of Na have been measured. The P terms show a quadratic effect $\propto n^7$ ($n =$ principal quantum no.) in accordance with the theory of Unsöld. The anomaly in the displacements of the (PP) lines in discharges of high c.d. and pressure (cf. Bartels, A., 1933, 107) is due to the inapplicability of the theory of the Stark effect to disturbances in the irregular field of the arc. O. D. S.

Identification and the origin of atmospheric sodium. R. BERNARD (Astrophys. J., 1939, **89**, 133—135; cf. A., 1938, I, 543).—A criticism (cf. A., 1938, I, 377). L. S. T.

Spectra of potassium, calcium, scandium, and titanium. L. W. PHILLIPS (Physical Rev., 1939, [ii], **55**, 708—709; cf. A., 1937, I, 485; Whitford, A., 1935, 2).—Data and classifications for 67 lines of the Al-like spectra of K VII and Ca VIII and of the Si-like spectra of Ca VII, Sc VIII, and Ti IX are tabulated. All known term vals. for these ions are listed. Approx. estimated ionisation potentials are Ca VII 127 v., and Sc VIII 158 v. N. M. B.

Emission band spectrum of chlorine. III. Continua. W. H. B. CAMERON and A. ELLIOTT (Proc. Roy. Soc., 1939, **A, 169**, 463—469; cf. A., 1938, I, 283).—An investigation of the spectrum of Cl excited by active N led to the discovery of a no. of new diffuse bands associated with the continuum having max. intensity at λ 2580 A. These are considered to be due to the neutral Cl_2 mol. G. D. P.

Zeeman effect of the forbidden lines of potassium. F. A. JENKINS and E. SEGRÈ (Physical Rev., 1939, [ii], **55**, 545—548; cf. A., 1939, I, 166).—The Zeeman effect of the lines S—S and S—D, absorbed in K vapour in an electric field of $\sim$2000 v. per cm., was investigated with a magnetic field of 27,000 gauss. The lines $4S$—$14S$ to $7S$—$19S$ showed no effect except for a slight broadening of the last few lines. The Zeeman patterns for $4S$—$12D$ to $4S$—$15D$, with the magnetic field perpendicular to the electric field and to the direction of observation, were resolved. They agree with the predicted pattern and show qualitatively the expected intensities. N. M. B.

Arc spectrum of vanadium in the violet. (MISS) C. E. MOORE (Physical Rev., 1939, [ii], **55**, 710—713; cf. Meggers, A., 1936, 1310).—Data and classifications for 263 lines in the region 2173—1848 A. are tabulated. Six new odd terms and 33 new miscellaneous odd levels have been found. N. M. B.

Effect of foreign gases on the continuous absorption spectrum of bromine. N. S. BAYLISS and A. L. G. REES (Nature, 1939, **143**, 560).—HCl, HBr, CO_2, O_2, and N_2 increase the intensity of the main absorption continuum of Br without altering the general shape of the absorption curve. The A and B components are equally affected, and there is practically no shift in the position of the max. at 4150 A. With HCl and CO_2, the increase in intensity is $\propto$ the partial pressure of the foreign gas. The ultra-violet absorption continuum between 3300 and 2500 A. is affected to a much greater extent by HCl or HBr. L. S. T.

Self-reversal of spectral lines. L. SIBAIYA (Proc. Indian Acad. Sci., 1939, **9**, A, 219—223).—From measurements on reversed lines obtained from cooled hollow-cathode sources (Ag, Cu, Mo, Au, etc.) it is concluded that the extent of self-reversal in the various lines of a given multiplet is not the same but that the ratio of the extent of self-reversal of two or more lines of a multiplet remains const. and independent of experimental conditions. The self-reversals in the two components of the same arc lines are unequal but the reversal ratio is const. and independent of experimental conditions. A theoretical explanation is advanced. W. R. A.

Spectrum of singly-ionised tellurium (Te II). K. R. RAO (Nature, 1939, **143**, 376).—In the spectrum of Te II the lines $\nu\nu$ 86,096, 82,742, 78,447 have been identified as forming the fundamental combination $5p^4S$—$6S^4P$ which has permitted the extension of the scheme into the region of longer $\lambda\lambda$. The structure is analogous to that of Se II. L. S. T.

Nuclear spin of iodine. IV. New type of hyperfine structure deviation from the interval rule. S. TOLANSKY (Proc. Roy. Soc., 1939, A, **170**, 205—222; cf. A., 1939, I, 1).—Eight terms in the I^+ spectrum are found to show deviation from the interval rule in their hyperfine structure. They can be fitted to a cubic interaction formula. Analysis is given for 13 newly classified lines. G. D. P.

Electric quadrupole moment of the iodine nucleus. K. MURAKAWA (Z. Physik, 1939, **112**, 234—241; cf. A., 1938, I, 335).—From the separation of the $(5s)(5p)^5\ ^3P_2$ fine structure terms, the quadrupole moment of ^{127}I is 0.8×10^{-24}. L. G. G.

Quadrupole moment and magnetic moment of the $^{127}_{53}I$ nucleus. T. SCHMIDT (Z. Physik, 1939, **112**, 199—207).—From hyperfine structure of the $5p^46s^4P_{3/2}$ and $_{5/2}$ I I spectrum the quadrupole moment for $^{127}_{53}I$ is -0.5×10^{-24} and the magnetic moment 2.8 nuclear magnetons. L. G. G.

Spectral series in neutral tungsten, W I, and limitations on the possibility of determining spectroscopic ionisation potentials. O. LAPORTE and J. E. MACK (Physical Rev., 1937, [ii], **52**, 249).—The identification of $5d^46s7s^7D_{12345}{}^5D_{04}$ and $5d^46s8s^7D_4$(?) leads to the series limit val. W I $5d^46s^2\ ^5D_0$ (normal state)—W II $5d^46s^6D_4 = 7.84$ v. The tentative val. for the ionisation potential is 7.6 ± 0.2 v. L. S. T.

Structure of the arc spectrum of tungsten, W I. J. E. MACK and O. LAPORTE (Physical Rev., 1937, [ii], **52**, 254). L. S. T.

Behaviour of the continuous radiation from mercury at high densities. R. ROMPE, P. SCHULZ, and W. THOURET (Z. Physik, 1939, **112**, 369—376).—The intensity of the continuous emission spectrum from the Hg discharge is measured photometrically over the density range $0.5—1.5 \times 10^{20}$ atoms per c.c. and current range 4—12 amp. The intensity of radiation $\propto I^{3/2}$, and nearly $\propto d$. Results are in accord with theory (Unsöld), and indicate a lowering of the excitation voltage at higher d and c.d. L. G. G.

Zeeman effect of hyperfine structure in intermediate fields. L. SIBAIYA and T. S. SUBBARAYA (Proc. Indian Acad. Sci., 1939, **9**, A, 211—218).—The Zeeman effect of the hyperfine structure of the 5461 A. Hg line at field strengths $\not\gg 4000$ gauss has been studied, and particularly the satellite $+0.753$ cm.$^{-1}$ arising from the transition $7^3S_1 f = 3/2 \rightarrow 6^3P_2 f = 3/2$ in ^{199}Hg. Experimental data agree well with theory. W. R. A.

Spectrum of Pb$_2$. L. NATANSON (Acta Phys. Polon., 1939, **7**, 275—278).—The band spectrum of Pb_2 has been obtained by passing an electrodeless discharge through a SiO_2 tube containing Pb vapour at 850°. 13 band heads between 4700 and 3700 A. have been measured and found to be higher members of the series observed in the region 4600—5200 A. by Shawhan (cf. A., 1935, 1292) using thermal excitation. J. A. K.

Normal and subnormal ratios and divisions of the glow discharge at a flat, semi-conducting electrode of heated glass. K. WOLF (Z. Physik, 1939, **112**, 96—106).—Using a cathode of heated glass, the electrode resistance, cathode fall, and general distribution of the discharge were investigated in air and H_2 at various voltages and gas pressures. H. C. G.

Sputtering from slightly conducting films formed in the discharge on heated glass. K. WOLF (Z. Physik, 1939, **112**, 148—158; cf. preceding abstract).—Slightly conducting films several μ. thick were produced on heated plane glass cathodes by the glow discharge in air, H_2, and Hg vapour. Under certain conditions these films give a sputtering discharge which passes smoothly into the ordinary glow discharge with increasing film thickness, lower temp., or increasing c.d.; dependence of the phenomenon on these factors has been investigated. H. C. G.

High-pressure arcs in common gases in free convection. C. G. SUITS (Physical Rev., 1939, [ii], **55**, 561—567).—An oscillographic method is described for measuring the electric gradient E (v. per cm.), c.d. I (amp. per sq. cm.), and total voltage e (v.) as a function of current i in the discharge. Results are given and plotted for arcs in the range 0—10 amp. with free convection in N_2, A, and He at 1—50 atm., and for air, CO_2, and steam at atm. pressure. Determinations of n and B in $E = Bi^{-n}$ and of m in $E = B_0 p^m$ were obtained. N. M. B.

Explanation of the lines in the spectrum of the solar corona. W. GROTIAN (Naturwiss., 1939, **27**, 214).—It is suggested that the spectrum lines of the solar corona may be explained as forbidden lines of highly ionised atoms. A. J. M.

Influence of chemical binding and crystal structure on X-ray absorption edges. R. LANDSHOFF (Physical Rev., 1939, [ii], **55**, 631—636; cf. A., 1938, I, 346).—An attempt is made to explain the positions and fine structures of X-ray absorption edges, so far as these are not explained by Kronig's theory, by considering that they arise from transitions into a series of discrete states in which the electron is trapped in the region of surplus positive charge

which is created by the ejection of the electron from the inner shell of the parent ion. A model in which the electron is bound to the positive ions in the neighbourhood of the parent ion is used to calculate the energy of the trapped states. Data for Cl^- and S^{--} in several compounds are given and discussed. N. M. B.

Ionisation of mercury. T. McFadden (Physical Rev., 1939, [ii], **55**, 797).—Investigations with a modified space-charge tube give results in general agreement with those recently reported (cf. Nottingham; Bell, A., 1939, I, 168). N. M. B.

Townsend ionisation coefficients in Cs–Ag–O photo-tubes filled with argon. W. S. Huxford (Physical Rev., 1939, [ii], **55**, 754—762).—An attempt is made to account for the amplification of photo-currents at low c.d. on the basis of Townsend's theory, assuming secondary electron emission by positive ions. Using special sealed-off tubes having parallel plates at various separations, and a const. gas pressure, vals. of the Townsend coeffs. α and γ were determined at each field val. by simultaneous solution of the Townsend equations for two plate separations. Measured vals. of the striking potentials of the glow discharge are in quant. agreement with the positive ion mechanism assumed. The photosensitivity of the compound Cs cathodes increases with increase of bombarding ion current. N. M. B.

Time changes in emission from oxide-coated cathodes. J. P. Blewett (Physical Rev., 1939, [ii], **55**, 713—717; cf. Becker, A., 1932, 208).—The decay of electron emission when emission-limited current is drawn from an oxide cathode (BaO–SrO) was studied as a function of anode voltage, anode current, cathode temp., and tube temp. It is concluded that the decay is due to a transport of Ba or O by electrolysis and diffusion. The val. deduced for the heat of diffusion is 17 ± 5 kg.-cal., or ~0.7 ev. Other observed time variations in emission are discussed. N. M. B.

Total secondary electron emission from tungsten and thorium-coated tungsten. E. A. Coomes (Physical Rev., 1939, [ii], **55**, 519—525; cf. A., 1939, I, 2).—The secondary electron emission from polycryst. W covered with unimol. films of Th evaporated on to it from a thoriated W filament, investigated for a primary electron energy range of 100—1000 v., showed no change in the val. of the coeff. with thoriation for primary energies <200 v., but decreased at higher voltages with increasing amounts of Th on the target. Treatment with O_2 released from the thoriated W filament caused an increase in the work function and also in the secondary emission coeff. N. M. B.

Influence of gases on the secondary emission of certain metals. N. Chlebnikov (Tech. Phys. U.S.S.R., 1938, 5, 593—618).—Apparatus for measuring the "coeff. of secondary emission," σ, is described. The metals examined were deposited by distillation in vac. on a Ta plate. Freshly deposited Be or Mg gave $\sigma_{max.}$ ~0.9 with primary beam voltage ~300 v. Brief exposure to O_2 increased $\sigma_{max.}$ to 2—3; H_2 and He also increased σ but the effect was more complicated.

The emission from pure Ta was similarly influenced by traces of residual gases; outgassing reduced $\sigma_{max.}$ from 2·2 to 1·2. A theory of the mechanism of emission has been developed to explain the results. The resistance of thin films of Be, Ni, W, and Ag increases sharply on exposure to O_2 and slightly with H_2. J. A. K.

Secondary electron emission from oxide-coated cathodes. N. Morgulis and A. Nagorski (Tech. Phys. U.S.S.R., 1938, 5, 848—863).—The secondary electron emission from a (Ni)–BaO, Ba–Ba cathode is < that from a Cs_2O cathode, but does not show a time lag even when cold. The energy distribution of the secondary electrons was determined at different temp. Thermo-electronic emission is > secondary emission at 600° K. and a device for separating the two effects is described. The secondary emission increases considerably with rise of temp. particularly above 600° K. and the increase is almost unaffected by the energy of the primary electrons (400—1000 v.). A. J. M.

Absolute light yield, excitation functions, and intensity relations in helium, neon, and argon spectra excited by atomic collision at velocities from 0 to 4500 volts. V. Neumann (Ann. Physik, 1939, [v], **34**, 603—624).—The processes Ne → Ne, He → He, A → A, He → A, and H → Ne, He, and A have been investigated. In each case excitation by similar atoms is the most efficient. Results are compared with those for excitation by electron collision. O. D. S.

Measurement of the excitation function of metals of high b.p. on excitation by electron collision. H. Fuhrmann (Ann. Physik, 1939, [v], **34**, 625—643).—By means of a new apparatus the excitation functions for electron collision of lines in the spectra of Tl (cf. Strohmeier, A., 1937, I, 590), Ag, and Pb have been measured. Ag shows characteristics similar to Tl and Na. Contrary to expectation, the singlet and triplet lines of Pb, which has a triplet ground term, do not show a reversal in their characteristics as compared with those of Cd, Zn, and Hg. O. D. S.

Fluctuation of thermionic current and the "flicker" effect. M. Surdin (J. Phys. Radium, 1939, [vii], **10**, 188—189).—Mathematical. The fluctuation of the thermionic current of the "flicker" effect can be attributed to the fluctuation in the no. of free electrons in the metal. W. R. A.

Scattering of fast electrons and of cosmic-ray particles. E. J. Williams (Proc. Roy. Soc., 1939, A, **169**, 531—572; cf. A., 1938, I, 224).—The relativistic theory of nuclear scattering is discussed and corrections are applied for the effects of finite nuclear size and the shielding of the nucleus by the at. electrons. The average deflexions due to multiple scattering of fast electrons in thin metal foils and of cosmic-ray particles in metal plates are calc. The theoretical results are in agreement with experiment on the scattering of cosmic-ray particles; reference is made to the bearing of the cosmic-ray results on the existence of "heavy electrons." The scattering of million-v. electrons by Al foil is in agreement with

the theory but that of 10-Mv. electrons by Pb foil is ≪ the theoretical vals.   G. D. P.

Mass of the mesotron. Y. NISHINA, M. TAKEUCHI, and T. ICHIMIYA (Physical Rev., 1939, [ii], 55, 585—586; cf. A., 1938, I, 57).—Investigations on a Pb bar mounted in a Wilson cloud-chamber showed the track of a negatively charged particle of range 6·15 cm. for which the calc. mass is $(170 \pm 9)m$, where m is the mass of the electron. The corr. val. of a result previously reported is $(180 \pm 20)m$.   N. M. B.

New effect in the asymmetry of radiation from hydrogen positive rays in an electric field. R. GEBAUER (Naturwiss., 1939, 27, 228).—The Stark effect components of the H_β and H_γ lines in an electric field were observed simultaneously with two spectral apparatus in opposite directions, both perpendicular to the positive rays and to the direction of the field. When the field was made slightly inhomogeneous asymmetry of the components was observed, the width of the short-wave component being > that of the long-wave component when viewed in one direction, and the reverse in the opposite direction. The effect is not a Doppler effect.   A. J. M.

Determination of the mobilities of gaseous ions. (MLLE.) E. MONTEL (Compt. rend., 1939, 208, 1141—1144).—A new method has been devised for the determination of the mobilities of gaseous ions in which the ions, produced by X-ray irradiation, are subjected to the influence of an electric field and the current produced by their displacement is amplified and measured.   W. R. A.

Production of ions in the auroral glow. J. KAPLAN (Physical Rev., 1937, [ii], 52, 257).—Hypothetical.   L. S. T.

Classification and correspondence of the chemical elements and their compounds. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], 6, 677—683).—An arrangement of the periodic table corresponding with electronic structures.   F. J. G.

Mases of ^{6}Li, ^{7}Li, ^{8}Be, ^{9}Be, ^{10}B, and ^{11}B. S. K. ALLISON (Physical Rev., 1939, [ii], 55, 624—627).—Vals. are deduced with the help of energy release data in the two modes of disintegration of Be under proton bombardment (cf. A., 1939, I, 172). The introduction of the revised electronic charge makes changes <0·07% in the accepted range–energy curve for α-particles. Assuming $H = 1 \cdot 00813 + 0 \cdot 00002$, $D = 2 \cdot 01473 \pm 0 \cdot 00002$, and $^4He = 4 \cdot 00386 \pm 0 \cdot 00006$, the deduced masses are $^6Li = 6 \cdot 01670 \pm 0 \cdot 00012$, $^7Li = 7 \cdot 01799 \pm 0 \cdot 00011$, $^8Be = 8 \cdot 00753 \pm 0 \cdot 00013$, $^9Be = 9 \cdot 01474 \pm 0 \cdot 00014$, $^{10}B = 10 \cdot 01579 + 0 \cdot 00022$, and $^{11}B = 11 \cdot 01244 \pm 0 \cdot 00019$. These masses are compared with several observed nuclear reactions and mass-spectrographic doublets.   N. M. B.

Mass of the normal litre and compressibility of gaseous carbon monoxide. At. wt. of carbon. E. MOLES and M. T. SALAZAR (Congr. int. Quim. pura apl., 1934, 9, II, 217—224; Chem. Zentr., 1937, i, 1115).—The at. wt. val. 12·007 ± 0·001 is obtained, the ratio $^{12}C : ^{13}C$ being 100 : 1.   A. J. E. W.

Determination of the at. wt. of lead by the Richards–Hönigschmid method. I. Preparation of chemically pure silver as a standard for determination of the at. wt. of lead. V. M. PERMJAKOV (J. Gen. Chem. Russ., 1938, 8, 1881—1886).—Ag containing 0·3—0·5 p.p.m. of Ca is prepared by the method of Hönigschmid (Mitt. Inst. Radiumforsch. Wien, 1914, 56, 5; 1916, 86, 10), with minor modifications.   R. T.

Constancy of ^{40}K. A. K. BREWER (Physical Rev., 1939, [ii], 55, 669).—Investigations on K minerals of various ages and from various sources support the conclusions of Smythe (cf. A., 1939, I, 171) that the $^{39}K/^{40}K$ abundance ratio is comparatively const. throughout nature.   N. M. B.

Enrichment of xenon isotopes and their detection. W. GROTH (Naturwiss., 1939, 27, 260—261).—The Hertz diffusion process and the Clusius separation method were used simultaneously in the separation of Xe isotopes. A Clusius separation tube 1 m. long can be as effective as 12 Hertz diffusion pumps, and a better separation was effected if the diameter of the tube was decreased to 0·5 cm. With wire temp. of 1200° and 1650° the variation in the at. wt. of the fractions collecting at the " light " and " heavy " ends of the apparatus was plotted against time. The thermal conductivity method was used for the analysis of the fractions and differences >1 at. wt. unit were obtained.   A. J. M.

Isotopic constitution of hafnium, yttrium, lutecium, and tantalum. A. J. DEMPSTER (Physical Rev., 1939, [ii], 55, 794—795).—Photographs of ions obtained from a high-frequency spark showed a new isotope ^{174}Hf, with intensity 0·3% of the total; there was also indication of a possible ^{172}Hf. No confirmation could be obtained of ^{177}Lu and ^{179}Ta, nor of a Y isotope of at. mass 91.   N. M. B.

Isotopic abundance and at. wt. of europium. H. LICHTBLAU (Naturwiss., 1939, 27, 260).—The isotopic abundance of Eu has been determined; ^{151}Eu : ^{153}Eu = 96·3 ± 1·2 : 100. No other isotopes were discovered, and if present cannot be >0·4%. The mean mass no. is $152 \cdot 019 \pm 6 \times 10^{-3}$. Using Dempster's val. for the packing fraction, and converting to the chemical scale, the at. wt. of Eu is 151·95 ± 0·01, or using Aston's val. for the packing fraction the val. is 151·92 ± 0·03.   A. J. M.

Radioactivity of glass, porcelain, and mica. S. GAWRONSKI (Acta Phys. Polon., 1939, 7, 253—271). —By a counter method weak natural radioactivity has been detected in insulator porcelain, two glasses, and three different micas. The nature of the rays was examined by measurement of the absorption in thin sheets of Cu and Al. The radiations from porcelain and Indian mica were found to be homogeneous and corresponded in penetrating power with the β-radiation of K. The other materials gave inhomogeneous radiations which were approx. separated and identified as follows : Fischer glass, Ra (γ), K (β), and Ra-B (γ); Thuringer glass, U-X_2 (β and γ), and Ra-B (γ); East African mica, K (β) slightly inhomogeneous; Madagascar mica, Th-C'' (β) and Ra (β).   J. A. K.

Actinium series of radioactive elements and their influence on geological age measurements. A. V. GROSSE (Physical Rev., 1939, [ii], 55, 584—584). —A confirmatory discussion of the results of Nier (cf. A., 1939, I, 169) and an examination of discrepancies.   N. M. B.

Energy loss of high-energy β-rays in lead. J. J. TURIN and H. R. CRANE (Physical Rev., 1937, [ii], 52, 247).—Using β-rays from ^{8}Li, cloud-chamber measurements of the loss of energy of electrons in passing through Pb have been extended to incident energies of 11 Me.v. For 0·5 mm. of Pb, average losses are 50% > predicted vals.   L. S. T.

β-Ray spectrum of radium-E. L. H. MARTIN and A. A. TOWNSEND (Proc. Roy. Soc., 1939, A, 170, 190—205).—A magnetic β-ray spectrometer is described. The β-ray spectrum of a source of Ra-E in equilibrium with Ra-D was investigated, special attention being paid to the effect of back-scattering in the source support and absorption in the window of the counter. The results cannot be explained by the Fermi theory or the modification of Konopinski and Uhlenbeck.   G. D. P.

γ-Rays of radium-E. J. A. GRAY (Physical Rev., 1939, [ii], 55, 586—587).—Curves for the absorption in Al of the soft γ-rays of Ra-E and for the production of X-rays in Al by the fast and slow β-rays from Ra-E are given and discussed.   N. M. B.

γ-Rays from boron and beryllium under proton bombardment, and from lithium under deuteron bombardment. W. G. SHEPHERD, R. O. HAXBY, and J. H. WILLIAMS (Physical Rev., 1937, [ii], 52, 247).—Under proton bombardment, B emits a hard γ-ray. The resonance observed at 180 kv. has been confirmed. No γ-rays harder than background X-rays from the accelerating tube have been observed from Be bombarded by 200-kv. protons. The γ-ray from Li under deuteron bombardment has an energy of 400±25 kv.   L. S. T.

Intensity distribution in Compton scattering of γ-rays. Z. BAY and Z. SZEPESI (Z. Physik, 1939, 112, 20—28).—A method of greatly increased accuracy for measuring the angular distribution of secondary radiation excited by γ-rays is described. Results are given for Al between the angles 50° and 140°; these agree with vals. calc. from the formula of Klein and Nishina.   H. C. G.

Nuclear effect and scattering of γ-rays. Z. BAY and G. PAPP (Z. Physik, 1939, 112, 86—91).— Intensity distribution of scattered radiation arising from the incidence of γ-radiation from Ra on sheets of Pb and Al is independent of the angle. Comparison between nuclear scattering and Compton scattering shows the experimental results to agree with the calculations of Jaeger and Hulme and of Klein and Nishina.   H. C. G.

Gamma radiation from $^{198}_{79}$Au. G. J. SIZOO and C. EIJKMAN (Physica, 1939, 6, 332—336).—The γ-radiation contains a hard component with an energy of ∼2·5 Me.v., and an intensity of ∼0·02 quantum per disintegration.   L. J. J.

Low-energy neutrons from the deuteron-deuteron reaction. E. HUDSPETH and H. DUNLAP (Physical Rev., 1939, [ii], 55, 587—588; cf. Bonner, A., 1938, I, 339).—Using a cloud chamber containing H_2 and EtOH vapour and a D_3PO_4 target, the low-energy neutron spectrum was obtained. The intensity ratio of the high- and low-energy groups is ∼1 : 16.   N. M. B.

Neutron–proton scattering cross-section. L. SIMONS (Physical Rev., 1939, [ii], 55, 792—793).—In view of the divergence of calc. and experimental vals., measurements were made with different thicknesses of H_2O as a proton scatterer and I and Ag as detectors. The corr. mean free path of the resonance neutrons in H_2O was 0·91 cm., corresponding with a proton cross-section of 14·8 × 10^{-24} (cross-section for O = 3·3 × 10^{-24} sq. cm.). The discrepancy with Cohen's val. (cf. A., 1939, I, 172) is discussed.   N. M. B.

Production of photo-neutrons from a source with Ra-γ + Be. Z. OLLANO (Nuovo Cim., 1938, 15, 541—550).—Measurements have been made of the no. of neutrons obtainable from various Ra-γ + Be sources. The mean collision cross-section for the process in which the hardest γ-rays of Ra liberate neutrons from Be is 2·0±0·3 × 10^{-27} sq. cm.   O. J. W.

Scattering of neutrons by iron. R. F. BACHER (Physical Rev., 1937, [ii], 52, 248).—The scattering of Rh resonance neutrons by thick and thin Fe scatterers above a detector on a paraffin cylinder has been investigated. The albedo effect contributes largely to the scattering. For 5·4 cm. of Fe, the ratio of absorption to scattering cross-section is 0·22.   L. S. T.

Distribution of particles of disintegration of nitrogen under the action of fast neutrons. Resonance levels of the ^{15}N nucleus. J. THIBAUD and P. COMPARAT (J. Phys. Radium, 1939, [vii], 10, 161—170).—A detailed account of work already noted (cf. A., 1938, I, 427, 489; 1939, I, 53).   W. R. A.

Scattering of fast neutrons of different energy. H. AOKI (Physical Rev., 1939, [ii], 55, 795; cf. A., 1939, I, 171).—Curves of the scattering cross-section of 32 elements for D + D and Li + D neutrons of energies 2·1—2·8 Me.v. at various angles to the incident deuteron are given and discussed.   N. M. B.

Emission of neutrons during the artificial disintegration of uranium nuclei. Possibility of chain reaction. C. HAENNY and A. ROSENBERG (Compt. rend., 1939, 208, 898—900).—With the aid of a hexane-ionisation chamber (A., 1938, I, 289) it has been shown that a neutron beam tends to increase in intensity during passage through a large amount of U. The effect is attributed to secondary emission of neutrons from disintegrated nuclei replacing the absorbed primary neutrons. The chain effect obtained suggests the possibility of using U to intensify weak sources of neutrons and of producing appreciable quantities of the transmutation products.   J. W. S.

Delayed neutron emission which accompanies fission of uranium and thorium. R. B. ROBERTS, L. R. HAFSTAD, R. C. MEYER, and P. WANG (Physical Rev., 1939, [ii], 55, 664).—Further evidence shows

that direct neutron emission, and not photodisintegration, is responsible for the delayed neutrons produced by neutron bombardment of U (cf. A., 1939, I, 235). The measured cross-section for the production of delayed neutrons by Li-neutron bombardment of U (high-energy neutrons) was ~4 × 10⁻²⁶ sq. em. which is ~ one half the cross-section for fission when fast Rn–Be neutrons are used. Delayed neutrons were observed from $Th(NO_3)_3$ which had been activated by fast Li neutrons. The intensity was ~$\frac{1}{4}$ of that observed from U; the period was ~ the same as that of delayed neutrons from U. N. M. B.

γ-Rays from uranium activated by neutrons. J. C. MOUZON, R. D. PARK, and J. A. RICHARDS, jun. (Physical Rev., 1939, [ii], 55, 668).—Integral curves for runs of photographs obtained when U nitrate in a Pb envelope was bombarded with neutrons in a cloud-chamber filled with air and EtOH vapour in a magnetic field are given, together with the corresponding curve for the Pb in absence of U. Results indicate that the γ-rays above 4 or 5 Me.v. are associated with the fission process and are probably emitted by the excited products of the ruptured U nucleus. N. M. B.

Cross-sections of metallic uranium for slow neutrons. M. D. WHITAKER, C. A. BARTON, W. C. BRIGHT, and E. J. MURPHY (Physical Rev., 1939, [ii], 55, 793).—Since cross-sections obtained by investigations on elements and on their compounds are liable to differ, measurements of the transmission of U metal for slow neutrons are reported. The results obtained are : total cross-section 23·1±0·5 × 10⁻²⁴; capture cross-section 11±3 × 10⁻²⁴; scattering cross-section 12±3 × 10⁻²⁴ sq. cm. N. M. B.

Production of neutrons in uranium bombarded by neutrons. H. L. ANDERSON, E. FERMI, and H. B. HANSTEIN (Physical Rev., 1939, [ii], 55, 797—798).—Preliminary experiments with a Rn + Be source of neutrons and with photo-neutrons emitted from a block of Be irradiated with γ-rays from Ra support the view that neutrons are emitted by U under neutron bombardment. N. M. B.

Instantaneous emission of fast neutrons in the interaction of slow neutrons with uranium. L. SZILARD and W. H. ZINN (Physical Rev., 1939, [ii], 55, 799—800; cf. preceding abstract).—Using photo-neutrons liberated from a Be block by the γ-rays of Ra and slowed down by paraffin wax, together with a He-filled ionisation chamber and amplifier detector, an emission of fast neutrons in the U fission process was found. Replacement of the He chamber with an ionisation chamber lined with U_3O_8 allowed an estimation of ~2 neutrons per fission to be made. Indications were obtained that the no. of neutrons due to delayed emission must be very small (cf. Roberts, A., 1939, I, 235). N. M. B.

Artificial radioactivity. IV. K. DIEBNER and E. GRASSMANN (Physikal. Z., 1939, 40, 297—314; cf. A., 1938, I, 381).—Further results to the end of 1938 are reviewed.

Radioactivity of ⁸Li. C. KITTEL (Physical Rev., 1939, [ii], 55, 515—519; cf. Rumbaugh, A., 1937, I, 5).—The continuous distribution of α-particles, which is not given correctly by the Konopinski–Uhlenbeck theory, observed in the β-decay of ⁸Li is examined theoretically on the Fermi theory of β-decay and is accounted for by an approx. form of this theory. The abnormally small val. found for Fermi's const. g for the β-decay process classes the process as improbable. N. M. B.

Internal conversion electrons from ⁸⁰Br. G. E. VALLEY and R. L. McCREARY (Physical Rev., 1939, [ii], 55, 666; cf. Segrè, A., 1939, I, 169).—The negative electron spectra of ⁷⁸, ⁸⁰, ⁸²Br produced by proton bombardment of thin Se films were examined in the region 13—150 e.kv., and showed two strong lines of electrons at 44±1 and 33·5±1 e.kv., and a much weaker line at 21·5±2 e.kv. The 44 and 33·5 lines belong to ⁸⁰Br (4·4 hr.), and agree with L and K conversion in Br of a γ-ray of ~45 e.kv.; the 21·5 line belongs either to ⁸⁰Br (4·4 hr.) or to ⁸²Br (33 hr.) and is the result of either L conversion of a 23-e.kv. γ-ray or K conversion of a 34-e.kv. γ-ray. N. M. B.

Excited states of nuclei. F. J. WISNIEWSKI (Acta Phys. Polon., 1939, 7, 245—252).—γ-Rays of energies 4, 6·9, and 12 Me.v. are observed during the reactions $^7_3Li + ^1_1H = 2^4_2He$ and $^6_3Li + ^1_1H = ^4_2He + ^3_2He$. From theoretical calculations of the energies of excited states of nuclei, these rays have been ascribed to ⁷Li, ⁴He, and ⁶Li, respectively. J. A. K.

Coincidence investigations of the nuclear transformation of boron by protons. K. FINK (Ann. Physik, 1939, [v], 34, 717—739).—Coincidence measurements indicate that ⁸Be formed in the process ¹¹B (p, α) ⁸Be disintegrates spontaneously into two α-particles. The results of absorption measurements on the α-particles formed cannot be interpreted on the assumption that disintegration is isotropic with respect to the centre of gravity of the ⁸Be nucleus. Coincidence measurements for the process ¹¹B (p, α) αα also indicate a non-isotropic disintegration. O. D. S.

Short-range α-particles from ¹⁹F + ¹H. W. B. McLEAN, R. A. BECKER, W. A. FOWLER, and C. C. LAURITSEN (Physical Rev., 1939, [ii], 55, 796).—The γ-ray spectrum from the bombardment of ¹⁹F by protons of energies ≯750 kv. consists of a single line at 6·0±0·2 Me.v., and a first resonance at 330 kv. (cf. Hafstad, A., 1936, 1313). The range distribution curve of particles produced by the bombardment of CaF_2 (¹⁹F) with 350-kv. protons is consistent with the assumption that the group consists of α-particles due to the reaction $^{19}F + ^1H \rightarrow (^{20}Ne) \rightarrow ^{16*}O + ^4He + Q$; $^{16*}O \rightarrow ^{16}O + h\nu$. The calc. val. of Q = 1·74±0·10 Me.v. so that the excited state of O involved lies 6·2 Me.v. above the ground state, in good agreement with the observed γ-ray energy. N. M. B.

Radioactivity produced in sulphur and phosphorus by fast neutrons. J. CICHOCKI and A. SOLTAN (Acta Phys. Polon., 1939, 7, 240—244; cf. A., 1938, I, 489).—Fast neutrons from Li + D induce in S a radioactivity of half-life 2·6 hr. found chemically to be $^{31}_{14}Si$ formed by $^{34}_{16}S + ^1_0n = ^{31}_{14}Si + ^4_2He$. The activity is identical with that produced by the reaction $^{31}_{15}P + ^1_0n = ^1_1H + ^{31}_{14}Si$ (half-life 157·1±

1·0 min.) The half-life of $^{30}_{15}P$ produced by $^{31}_{15}P +$ $^1_0n = 2^1_0n + ^{30}_{15}P$ is 130·6±1·5 sec., and that of $^{32}_{15}P$ from $^{32}_{16}S + ^1_0n = ^{32}_{15}P + ^1_1H$ is 14·33±0·2 days.

J. A. K.

Excitation functions of the transformations $^{27}_{13}Al$ (α ; n) $^{30}_{15}P$ **and** $^{10}_{5}B$ (α ; n) $^{13}_{7}N$. A. SZALAY (Z. Physik, 1939, **112**, 29—44).—The transformations were produced by α-particles of 5·3 Me.v. in an apparatus embodying a spherically symmetrical arrangement about an approx. point source of a prep. of Po. Abs. yields of the transformation products, and resonance energies of the transformations, were determined and compared. A selection rule for the branching transformation of the intermediate nucleus, ^{31}P, is established.

H. C. G.

Chemical separation of isomeric ^{80}Br **atoms.** L. J. LE ROUX, C. S. LU, and S. SUGDEN (Nature, 1939, **143**, 517—518).—The addition of a few % of NH_2Ph to an org. bromide before irradiation with slow neutrons gives a large increase in the amount of radio-Br which can be extracted subsequently by H_2O or dil. acid. The capture γ-rays disrupt or activate the C·Br linking and facilitate the reaction $RBr + NH_2Ph = NH_2RPh^+ + Br^-$. This reaction gives a large separation of the ^{80}Br isomerides, and a curve showing the separation obtained when 5% of NH_2Ph are added to $C_2H_4Br_2$ irradiated with slow neutrons from $RaSO_4 + Be$ is given. The hydrolysis of Bu^aBr under the conditions described also gives a marked separation of the isomeric ^{80}Br atoms. These results confirm the finding of Segrè et al. (A., 1939, I, 169) and DeVault and Libby (ibid., 173) that the isomeride of ^{80}Br with a half-life of 4·5 hr. decays by a γ-ray change to an isomeric ^{80}Br emitting β-rays with a half-life of 18 min.

L. S. T.

Wave-length relationship of nuclear photo-effects : the radioactive isotopes of selenium. W. BOTHE and W. GENTNER (Z. Physik, 1939, **112**, 45—64).—An electrostatic generator and canal-ray tube for operation at 1000 kv. are described. Nuclear photo-effects were examined and relative yields determined for a series of elements using the γ-radiation from ^{11}B (p ; γ) ^{12}C. Spurious effects arising from neutrons were eliminated by control experiments. Nuclear γ-absorption spectra are essentially continuous and, in general, the absorption increases with increasing $h\nu$. The apparent reaction cross-section of Cu with γ-radiation from ^7Li (p ; γ) ^8Be is 2·3 times $<$ that with γ-rays from ^{11}B (p ; γ) ^{12}C. Mixture ratios of the two ^{80}Br isomerides are 0·9 with the Li radiation and 2·6 with B radiation. The 4·5-hr. ^{80}Br isomeride is possibly a metastable excited state of the 18-min. isomeride and its proportion increases with increase in excitation of the ^{81}Br intermediate nucleus from which ^{80}Br results by neutron emission. Nuclear photo-effects with Se produce two radio-active isotopes. Their decay curve corresponds with the two known half-life periods of 17 and 57 min. They result from neutron emission and have masses 75, 79, or 81. Snell's Br (2·4-hr.) isotope cannot arise from Se activated by either photo-effect or slow neutrons ; it may be derived from a third Se isotope of unknown period, produced in very small quantity.

H. C. G.

New periods of radioactive tin. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1939, [ii], **55**, 667).—The Sn ppt. prepared by bombardment of Sn with 5-Me.v. deuterons contains activities of half-lives 9 min., 40 min., 26 hr., 10 days, ~70 days (all negative), and ≮400 days (sign unknown). Possible identifications are discussed ; the most probable are 9 min. ^{125}Sn, 70 days ^{113}Sn. The previously reported ^{121}Sn (24 hr.) is probably in error (cf. A., 1936, 1315). A chemical separation for Sn after activation of Cd with 16-Me.v. He ions gives a ppt. containing activities 70 days (sign unknown), 25 min., 3 hr., and 13 days (all negative).

N. M. B.

Radioactive tellurium : further production and separation of isomers. G. T. SEABORG, J. J. LIVINGOOD, and J. W. KENNEDY (Physical Rev., 1939, [ii], **55**, 794 ; cf. A., 1939, I, 233).—The constituents of three isomeric pairs were separated chemically by the method of Segrè (cf. ibid., 169) ; in each case the short-period grows from the long-period activity. Prolonged bombardment of I with fast neutrons from Li + D produces ^{127}Te (90 days and 10 hr.) ; these activities are produced with much greater intensity by deuteron bombardment of Te. ^{131}Te (1·2 days and 25 min.) are produced by deuteron bombardment of Te, and ^{129}Te (30 days and 70 min.) are similarly produced. Activation of Sb with 8-Me.v. deuterons or with 4-Me.v. protons gives ^{121}Te (120 days).

N. M. B.

Radiations from radioactive substances: ^{198}Au, ^{152}Eu, ^{106}Ag, ^{64}Cu, **and** ^{13}N. J. R. RICHARDSON (Physical Rev., 1939, [ii], **55**, 609—614).—The γ-radiation from ^{198}Au and ^{152}Eu was investigated with a H_2-filled cloud-chamber in a magnetic field. ^{198}Au (2·7 days) shows three lines with energies 70, 280, and 440 kv., and relative intensities 0·15, 1·0, and 1·2. The β-spectrum has an inspection upper limit of 0·83 Me.v., and the distribution shows that the 440-kv. γ-radiation is internally converted with a coeff. of 0·1 ; thus the 70-kv. radiation is probably entirely K radiation emitted after internal conversion. The ^{152}Eu γ-distribution shows three main groups of 40 kv., 0·3 and 0·9 Me.v. The 40-kv. radiation is ascribed to the K radiation of Sm emitted as a consequence of the orbital electron capture process in ^{152}Eu. ^{106}Ag (8 days) shows evidence for the K-electron capture process, the electron spectrum consisting probably of secondary electrons from the γ-radiation following the capture process. Comparison of the distribution of electrons ejected from a Pb radiator and from ^{64}Cu by a thin source of ^{13}N indicates the presence of a 280-kv. γ-ray from ^{13}N with the relative probability of ~0·4 quantum per positron.

N. M. B.

Energy distribution of the products of irradiation of uranium with neutrons. G. VON DROSTE (Naturwiss., 1939, **27**, 198).—Four, instead of the two expected, groups of particles have been found as products of the irradiation of U with neutrons, the investigation being carried out by a thyratron and confirmed by an oscillograph method. The approx. max. energies of the groups are 33, 56, 71, and 95 Me.v.

A. J. M.

Products of irradiation of uranium with neutrons. I. NODDACK (Naturwiss., 1939, **27**, 212—

213).—The possibility of the disintegration of a nucleus into two nuclei lower in the periodic table was mentioned by the author in 1934. A. J. M.

Transmutations of uranium and thorium nuclei by neutrons. E. BRETSCHER and L. G. COOK (Nature, 1939, **143**, 559—560).—Layers of U and Th oxides have been bombarded by a mixture of fast and slow neutrons from Li + D, and the active substances deposited on glass plates ~1 mm. away have been investigated. With U, half-lives of 86 min. have been assigned to Ba, of 4 hr. and 40 hr. to La, and of 16 min., 75 min., and 72—76 hr. to elements of the "trans-U" type. The 16-min. and 72—76-hr. activities are due to recoiling fragments of the bursting U nucleus; they are not "trans-U" elements from U by a chain of β-processes. With Th, the recoil activities on the plates show many periods, some of which have been classified into groups according to their chemical behaviour. L. S. T.

Droplet fission of uranium and thorium nuclei. M. A. TUVE (Science, 1939, **89**, 202—203).—The detection of the high-energy recoil particles demanded by the hypothesis of droplet fission of the U nucleus (A., 1939, I, 233) is described. The yields from Th and U exposed to Li + D neutrons at 10^3 kv. are similar in magnitude. No effect was observed from Bi, Pb, Tl, Hg, Au, Pt, W, Sn, or Ag. The U fissions appear to be produced by different processes for fast and slow neutrons, the fast-neutron process requiring >0·5 Me.v. but <2·5 Me.v. for effective operation. For Th, only the fast-neutron process is effective; it requires between 0·5 and 2·5 Me.v. L. S. T.

Dissymmetry of the rupture of uranium. G. BECK and P. HAVAS (Compt. rend., 1939, **208**, 1084—1086).—A general explanation of the rupture of U by neutrons into two non-identical nuclei is advanced. Beyond the range of nuclear radiations the only forces acting on the nuclei are coulombic forces. The probability of rupture becomes considerable only when the kinetic energy at this distance is positive. From this viewpoint nuclei with $Z = 37$ to 55 may be produced by the rupture. The ratio of λ_2, the period of rupture produced by neutrons, to λ_1, the period of spontaneous disintegration of $^{238}_{92}U$, gives the increased probability of rupture. W. R. A.

Further products of uranium cleavage. P. ABELSON (Physical Rev., 1939, [ii], **55**, 670).—Disintegration products of U have been found as follows : Sb (<15 min.) → Te (72 hr.) → I (2·5 hr.) and ^{131}I (8 days). Te (40 min.) → I (54 min.). Te (1 hr.) → I (22 hr.). Sb (4·6 hr.) → ^{129}Te (70 min.). Sb (5 min.) and Sb (40 min.). Separations and identifications are described and discussed. N. M. B.

Production of neutrons by cosmic rays. G. COCCONI and V. TONGIORGI (Naturwiss., 1939, **27**, 211).—The experiments of Froman et al. (A., 1939, I, 55) have been repeated, but the occurrence of neutrons to the extent of 30% of the hard component of cosmic rays could not be confirmed. If the effect is real it is ≪ this. A. J. M.

Variation of [cosmic-ray] shower intensity and mesotron disintegration over a period. J. BARNÓTHY and M. FORRÓ (Z. Physik, 1939, **112**, 208—214).—Observations of shower intensity together with barometer, temp., and magnetic effects during one year are examined. Differences between barometer and temp. effects on the vertical and shower intensities are explained on the basis of mesotron decomp. H. C. G.

Are there multiple charged primary particles in cosmic radiation ? M. S. VALLARTA (Physical Rev., 1939, [ii], **55**, 583).—The explanation of the latitude effect for large cosmic-ray bursts as reported by Jesse (cf. A., 1939, I, 236) gives rise to the possibility that the primary particles responsible for the effect may carry a multiple of the electron charge and have large mass. Other explanations are briefly discussed. N. M. B.

Hard component of cosmic radiation. A. BRAMLEY (Physical Rev., 1937, [ii], **52**, 248).—The abnormally low radiation losses of the penetrating particle responsible for this component are discussed. L. S. T.

Frequency of cosmic-ray showers produced in different metals. J. C. STEARNS and D. K. FROMAN (Physical Rev., 1937, [ii], **52**, 254—255).—The frequency of shower production in Pb, Sn, Cu, Fe, Zn, and Al has been determined. The no. of showers per atom is approx. $\propto$ (at. no.)² L. S. T.

Effects of time and meteorological factors on the intensities of cosmic-ray primaries and showers. D. K. FROMAN and J. C. STEARNS (Physical Rev., 1937, [ii], **52**, 255).—The hourly counting rate of a set of triple-coincidence Geiger–Müller counters has been observed for ~3000 hr. in counting ~190,000 showers from Pb, and for ~1500 hr. in counting ~160,000 vertical primary rays. An equation connecting counting rate with local time, atm. pressure, temp., humidity, and the earth's magnetic field is given. L. S. T.

Asymptotic orbits of primary cosmic rays. A. BAÑOS, jun. (Physical Rev., 1939, [ii], **55**, 621—623).—A comparison of results with those of Lemaître (cf. A., 1936, 774). N. M. B.

Penumbra at geomagnetic latitude 20° and the energy spectrum of primary cosmic radiation. R. A. HUTNER (Physical Rev., 1939, [ii], **55**, 614—620).—The method previously described (cf. A., 1939, I, 175) for obtaining the penumbra is applied to various energies. Variation of the penumbra with energy and the relation of intensity to energy distribution are examined. N. M. B.

Shallow tracks [produced] by cosmic rays. A. SHDANOV (Compt. rend. Acad. Sci. U.R.S.S., **22**, 163—165).—At. disintegrations produced by cosmic rays have been studied by the photographic technique previously employed (A., 1939, I, 236). By measuring the lengths of the proton tracks and the curvature of the mesotron tracks the momenta of the various particles have been determined and the conservation of momentum established for a no. of collisions. It is suggested that in addition to Bohr's liquid drop theory of nuclear disintegration other processes play a part in the interaction of cosmic rays and matter. T. H. G.

Stopping power of hydrogen at very low energies. F. T. ROGERS, jun. (Physical Rev., 1939, [ii], 55, 588).—From a cloud-chamber experiment on the binding energy of the deuteron (cf. A., 1939, I, 176) the calc. val. for the stopping power of H_2 for protons of energies $\leqslant 0.22$ Me.v. is ~ 0.35 (air = 1). N. M. B.

Ionising radiation emitted by ordinary metals. J. A. REBOUL (Ann. Physique, 1939, [xi], 11, 353—458).—The ionisation of a gas in a closed vessel is not due to a sp. radioactivity of the metal of the walls of the vessel, but is due partly to cosmic rays, and partly to a characteristic radiation of the metal, comprising one or two bands, emitted under the influence of cosmic rays. The radiation emitted by common metals has been investigated, and shown to consist of waves of λ comparable with that of soft X-rays, and possibly of positive and negative particles emitted from the surface with low velocities. The effect of the radiation on the photographic plate has also been investigated. The assumption that the effect is due to the formation of H_2O_2 at a metallic surface in contact with damp air does not explain all the facts, particularly the effects observed in atm. of H_2, N_2, and CO_2 and in vac. The formation of H_2O_2 may, however, play a subsidiary part in certain cases, and H_2O_2 may be produced by the radiation itself. A. J. M.

Scattering of radiation by the magnetic electron. W. FRANZ (Ann. Physik, 1938, [v], 33, 689—707).—Mathematical. The formula of Klein and Nishina (cf. A., 1929, 373) is generalised to include scattering by electrons of any spin before or after the scattering process. For magnetised Fe the influence of the direction of magnetisation on the intensity of twice scattered X- or γ-rays should be detectable by experiment. O. D. S.

Physical possibilities of stellar evolution. G. GAMOW (Physical Rev., 1939, [ii], 55, 718—725).—The evolution of gaseous bodies, caused by physical processes in their interior and serving as energy sources, is considered with reference to observed states of stars. N. M. B.

(A) E Region of the ionosphere, (B) during the total solar eclipse of 1 Oct., 1940. E. O. HULBURT (Physical Rev., 1939, [ii], 55, 639—645, 646—647).—(A) Observations for the years 1930—1938 of the diurnal variation of the max.-with-height val. of the equiv. electron density agree closely with the theory that, in daylight, the ionisation is caused by solar radiation absorbed exponentially in a relatively quiet terrestrial atm.

(B) Data for a suggested exact test of the theory are examined. N. M. B.

Advances in nuclear physics as a result of progress in apparatus and methods. J. MATTAUCH (Naturwiss., 1939, 27, 185—195, 201—205).—A review dealing with the development of the knowledge of the structure of the nucleus with particular reference to the apparatus employed. A. J. M.

Deviation of light atomic nuclei from the Hartree oscillator model. S. WATANABE (Z.

Physik, 1939, 112, 159—198).—Various deviations and their causes are examined mathematically. H. C. G.

Conception of surface tension in nuclear physics. J. SOLOMON (Compt. rend., 1939, 208, 896—898).—Theoretical. J. W. S.

Atomic nuclei. G. P. HARNWELL (J. Franklin Inst., 1939, 227, 443—459).—A review. A. J. M.

Structure of nuclei. F. J. WISNIEWSKI (Acta Phys. Polon., 1939, 7, 207—213).—Theoretical calculations of mass defects of H, He, Li, and Be nuclei. J. A. K.

Binding energy of the ^{16}N nucleus. B. RADZINSKI (Acta Phys. Polon., 1939, 7, 231—239).—Theoretical. The calc. binding energy is within 3.5% of the experimental val. J. A. K.

Analysis of nuclear binding energies. W. H. BARKAS (Physical Rev., 1939, [ii], 55, 691—698).—An analysis of the fine structure of the mass defect curve with special reference to the nuclear symmetry character leads to satisfactory empirical curves for functions in Wigner's theory (cf. A., 1937, I, 440). Deductions on nuclear shells and binding energies of known and unknown unstable nuclei are made, and computed and observed vals. of ~ 150 at. masses are tabulated. N. M. B.

Binding energies of light nuclei. W. A. TYRRELL, jun., K. G. CARROLL, and H. MARGENAU (Physical Rev., 1939, [ii], 55, 790).—On the basis of a method of calculation previously given (cf. A., 1939, 1, 6) upper bounds to the second-order perturbation energy for ^5He, ^6He, ^6Li, and ^7Li are obtained and divergences from Hartree approximation results are discussed. N. M. B.

Mass of the mesotron and of other elementary particles. A. PROCA and S. GOUDSMIT (Compt. rend., 1939, 208, 884—887).—The relationship between the observed mass of a particle at rest and its material mass, spin, and charge distinguishes between elementary particles with and without material mass. Application of the relation indicates that the mass of the mesotron is ~ 100 times that of the electron. J. W. S.

Electric quadrupole moment of the deuteron. R. F. CHRISTY and S. KUSAKA (Physical Rev., 1939, [ii], 55, 665).—Mathematical. The val. assumed by Kellogg (cf. A., 1939, I, 176) is corr. on the basis of theoretical spin–orbit interaction considerations. N. M. B.

Molecular beam resonance method for measuring nuclear magnetic moments. Magnetic moments of ^6_3Li, ^7_3Li, and $^{19}_9F$. I. I. RABI, S. MILLMAN, P. KUSCH, and J. R. ZACHARIAS (Physical Rev., 1939, [ii], 55, 526—535; cf. A., 1938, I, 172, 293).—A detailed account of a new method previously reported. Vals. found for ^7Li, ^6Li, and ^{19}F are 3.250, 0.820, and 2.622 nuclear magnetons, respectively. N. M. B.

Determination of the signs of nuclear magnetic moments by the molecular beam method of magnetic resonance. S. MILLMAN (Physical Rev., 1939, [ii], 55, 628—630; cf. preceding abstract).—It is shown that the method determines the sign of a

nuclear moment even though an oscillating perturbing field is substituted for the rotating field required by theory. The sign is obtained from an asymmetry in the resonance curve introduced by the end effects of the oscillating field. The signs for ^6Li, ^7Li, and ^{19}F were found to be positive, in agreement with known results. N. M. B.

Nuclear magnetic moment of beryllium. P. KUSCH, S. MILLMAN, and I. I. RABI (Physical Rev., 1939, [ii], **55**, 666—667).—From experiments on NaF,BeF_2 and KF,BeF_2, using the mol. beam magnetic resonance method, the val. of g, the ratio of the magnetic moment to the angular momentum of a nucleus, is 0.783 ± 0.003 for ^9_4Be, referred to that of ^7Li ($g = 2.167$). The sign of the moment is found to be negative (cf. preceding abstract). In the absence of any reliable val. for the spin no definite val. can be ascribed to the moment of the nucleus, and possible vals. are discussed. The most probable spin is $3/2$, giving -1.175 nuclear magnetons for the moment. N. M. B.

Magnetic moment in ferromagnetic alloys. I. Activation and the elementary moment. R. FORRER (J. Phys. Radium, 1939, [vii], **10**, 181—187). —A detailed account of work already noted (cf. A., 1939, I, 70, 131). W. R. A.

Self-consistent field for doubly ionised chromium. R. L. MOONEY (Physical Rev., 1939, [ii], **55**, 557—560).—Full calc. data for Cr III in the configuration $(3p)^6(3d)^4$ are tabulated. N. M. B.

Spectroscopic and free electron values of e/m. J. A. BEARDEN (Physical Rev., 1939, [ii], **55**, 584).— Contrary to the classification of Birge (cf. A., 1939, I, 56), the X-ray refraction measurement (cf. *ibid.*, 6) is in reality a free electron result, and a consequent regrouping of the two sets of vals. reveals the original discrepancy of results as obtained by the two methods. The average val. recommended for calculations, with probable error sufficient to include both sets of results, is $(1.7591 \pm 0.0008) \times 10^7$ abs. e.m.u. N. M. B.

Binary method for the determination of the constants of radiation. B. ALEXANDROV and A. COURTENER (Tech. Phys. U.S.S.R., 1938, **5**, 437—446).—All previous methods for the determination of radiation consts. have involved knowledge of the temp. of the surface of the radiating body. In a new method proposed, two receivers at different temp. are directed towards the same object. By solving the equations for the exchange of radiant energy between each receiver and the radiator the temp. of the latter can be eliminated. T. H. G.

The electron in the radiation field. O. SCHERZER (Ann. Physik, 1939, [v], **34**, 585—602).—Mathematical. O. D. S.

Temperature equilibrium and temperature measurement in flames. H. WOLFHARD (Z. Physik, 1939, **112**, 107—128).—Mol. conditions in hydrocarbon flames were investigated by spectrographic emission and absorption methods. The rotation of C_2 mols in a welding flame shows a Maxwell distribution and indicates a max. temp. of $5180°$ K. OH absorption bands are very strong and may be used to determine flame temp. Perturbation of the OH

mol. in flames and excitation states of the C_2 mol. are discussed. H. C. G.

NH bands in the night sky spectrum. J. KAPLAN (Physical Rev., 1939, [ii], **55**, 583).—The $\lambda 3360$ band in the afterglow spectrum of N_2 is identified as due to NH. It is proposed to identify the $\lambda 3374$ and $\lambda 3361$ bands in the night sky spectrum as the two Q branches of the (0, 0) and (1, 1) bands of NH at $\lambda 3360$ and $\lambda 3370$. There is evidence of direct combination of at. N and H in the high-pressure afterglow, and of the existence of at. N in the upper atm. N. M. B.

Band spectrum attributed to NBr. A. ELLIOTT (Proc. Roy. Soc., 1939, **A**, **169**, 469—475).—The spectrum of the afterglow of N containing Br vapour was photographed in the range 6500 to 5400 A. The vibrational structure of the observed band system is analysed and it is concluded that the bands are emitted by the mol. NBr. G. D. P.

Possible presence of cyanogen bands in spectra of red aurora of type B. R. BERNARD (Compt. rend., 1939, **208**, 1165—1167; cf. A., 1939, I, 229).— The spectrum of a mixture of N_2 and C, produced by electronic bombardment, contains bands due to CN superimposed on those of N_2. This spectrum is very similar to auroral spectra of type B and it is concluded that it is the presence of CN mols. in the atm. which gives rise to this type of auroral spectrum. W. R. A.

New ultra-violet band system of silver iodide. N. METROPOLIS (Physical Rev., 1939, [ii], **55**, 636—638; cf. Brice, A., 1931, 1211; Mulliken, A., 1937, I, 223).—A new system in the region 2100—2500 A. was photographed in absorption at 700—900°. At higher temp. the system is overlapped by strong continuous absorption advancing from shorter $\lambda\lambda$. The bands degrade to the red and form sequences; the most intense bands are near 2230 A. An additional new system at 2150 A. was found, and expressions for band heads of the two systems are given. N. M. B.

Spectra produced by electric discharges in carbon monoxide. A. CICCONE (Nuovo Cim., 1938, **15**, 532—540).—The conditions under which the Ångström, Swan, and high-pressure bands (cf. A., 1929, 964) appear in the spectrum of a discharge tube containing pure CO are described. With a very pure gas the high-pressure bands can be obtained alone. They are probably due to the CO mol. O. J. W.

Absorption spectra of carbon dioxide and carbon oxysulphide in the vacuum ultra-violet. W. C. PRICE and D. M. SIMPSON (Proc. Roy. Soc., 1939, **A**, **169**, 501—512).—In the case of CO_2 the electronic series converging to the lowest $^2\Pi g$ state of CO_2^+ have been identified and the ionisation potential is found to be 13.73 v. Certain weaker bands not of the Rydberg type were observed. The spectrum of COS is intermediate between those of CO_2 and CS_2, the differences being attributable to the lack of symmetry of the mol. G. D. P.

Coupling of vibrations with electronic levels in rare-earth compounds. J. P. HOWE and W. S. HERBERT (J. Chem. Physics, 1939, **7**, 277—278).—The absorption spectra of the solid anhyd. and hydrated

acetylacetonates of Pr and Nd have been observed in the near infra-red and visible at 78°, 120°, 193°, and 298° K. Plates taken at 120° K. showed progressions of weak diffuse bands separated by approx. const. intervals of 82 cm.$^{-1}$ (Pr) and 103 cm.$^{-1}$ (Nd) which are interpreted as vibrational νν. Application of the Franck–Condon principle explains the intensity of the bands. W. R. A.

Absorption band of formaldoxime at 9572 A. L. R. ZUMWALT and R. M. BADGER (J. Chem. Physics, 1939, **7**, 235—237).—CH_2:N·OH in the vapour state at 100° is monomeric and gives a single O–H band at 9572 A. (10,444·1 cm.$^{-1}$) with a structure seemingly that of a symmetrical rotator and a P–R branch separation of 31·0 cm.$^{-1}$ J vals. have been assigned to the lines and the probable vals. of two nearly equal moments of inertia have been computed. The structure of CH_2:N·OH is discussed and, from the data available, it is concluded that it is most probably planar. W. R. A.

Uric acid and cyanuric acid. The carbamyl group.—See A., 1939, II, 286.

Absorption of ultra-violet light by some organic substances. XLVIII. J. CHOLEWIŃSKI and L. MARCHLEWSKI. **XLIX. [Sorbose.] L. Some azines.** W. BEDNARCZYK and L. MARCHLEWSKI (Bull. Acad. Polonaise, 1938, A, 519—523, 524—528, 529—540).—XLVIII. Data for indigotin in $CHCl_3$ and for indirubin in EtOH and in $CHCl_3$ are recorded.

XLIX. Sorbose has an absorption max. at 2780—2800 A. similar to that of fructose (A., 1938, I, 59). Glucosone has also been examined.

L. On heating a solution of alloxazine (I) with an equiv. amount of o-$C_6H_4(NH_2)_2$,2HCl and a large excess of NaOAc a *ureide* (II), m.p. 238—239°, is formed. Neutral and acid solutions of (I) give almost identical spectra and presumably (I) has the same (probably heterocyclic) structure in both media. Absorption curves are also given for (II) in neutral and in alkaline solutions, (I) in alkaline solution, indophenazine in EtOH, and o-aminophenylhydroxyquinoxaline in EtOH. W. R. A.

Influence of temperature on ultra-violet absorption of benzene. M. AUBERT and T. D. GHEORGHIU (Ann. Off. nat. Combust. liq., 1938, **13**, 473—499).—Absorption spectra from 2380 to 2680 A. obtained at 23°, 120°, 200°, 300°, and 400° confirm the work of Henri and Cartwright (A., 1935, 805). The mechanism of predissociation is discussed. R. B. C.

Absorption spectra and constitution of benzene derivatives. V. 3-Hydroxy- and 3 : 5-dihydroxy-benzaldehyde. N. A. VALJASCHKO and M. M. SCHTSCHERBAK (J. Gen. Chem. Russ., 1938, **8**, 1399—1427).—The absorption spectra of m-OH·C_6H_4·CHO and 3 : 5-$(OH)_2C_6H_3$·CHO in EtOH, EtOH–NaOEt, and EtOH–HCl are compared with those of PhCHO, PhOH, and m-$C_6H_4(OH)_2$. The results agree with those expected on the basis of the theory of quantum resonance. R. T.

Analysis of the near ultra-violet electronic transition of benzene. H. SPONER, G. NORDHEIM,

A. L. SKLAR, and E. TELLER (J. Chem. Physics, 1939, **7**, 207—220).—Using data from various sources the absorption spectrum of gaseous C_6H_6 from 2200 to 2800 A. has been analysed. The vibrational structure agrees with selection rules for a forbidden transition ($^1A_{1g} \rightarrow {}^1B_{2u}$) rendered possible when E_g^+ vibrations distort the mol. This view is substantiated by comparison with the absorption spectra of solid C_6H_6, of C_6D_6, and with the fluorescence spectra of C_6H_6 and C_6D_6. W. R. A.

Spectrographic study of the action of alkalis on resorcinol. I—III.—See A., 1939, II, 259.

Structure and absorption spectra of hydroxytriphenylmethane dyes. Isomeric forms of hydroxyfuchsones.—See A., 1939, II, 260.

Effect of temperature and coupling on the intensity of infra-red harmonics. F. MATOSSI (Physikal. Z., 1939, **40**, 323—331).—Deviations from the normal behaviour of the intensity of infra-red harmonics in the spectra of silicates are ascribed to the effect of coupling with neighbouring oscillators. The dispersion theory of anharmonic linear coupled oscillators taking damping into account is developed. It is shown that coupling should exert a marked effect on the intensities of harmonics, the effect being dependent on the degree of coupling. An anomalous decrease in intensity of the first harmonic should occur where the oscillators have common atoms, as in the silicates. The two components of the first harmonic produced by coupling have different intensities. The absorption coeff. k usually increases with temp. in the neighbourhood of the first harmonic. At a frequency near the absorption max. k is independent of temp. From the displacement of the max. of k with temp. the const. of the anharmonic binding is calc. This is confirmed by experiments with BaO. A. J. M.

Perpendicular vibrations of the ammonia molecule. E. F. BARKER (Physical Rev., 1939, [ii], **55**, 657—662).—Absorption patterns of the 2, 3, and 6 μ. bands are examined. The vibration frequency ν_2 is identified by means of the combination bands $\nu_2 \pm \nu_3$ at 2·2 and 4 μ., and the numerical val. of ν_2 is fixed at 3415 cm.$^{-1}$ The fundamental band is recognised in the weak complex background of the absorption at 3 μ. The second perpendicular fundamental band at 6 μ. is partly resolved; the indicated val. of ν_4 is 1628 cm.$^{-1}$ The parallel component of $2\nu_4$ is found at 3220 cm.$^{-1}$, and two pairs of parallel combination bands $\nu_1 + \nu_3$ at 4270 and 4303 cm.$^{-1}$ and $2\nu_4 + \nu_3$ at 4177 and 4217 cm.$^{-1}$ N. M. B.

Infra-red and Raman spectra of polyatomic molecules. VI. Triborine triamine. B. L. CRAWFORD, jun., and J. T. EDSALL (J. Chem. Physics, 1939, **7**, 223—232).—Liquid $B_3N_3H_6$ (0·3 c.c. used) exhibits 14 Raman displacements, of which four are polarised. The infra-red spectrum (2·5—24·5 μ.) of the vapour consists of 19 bands. The mol. symmetry D_{3h} has been assigned and the mol. should therefore have 20 distinct internal vibrations (10 doubly degenerate), of which 14 are planar and 6 involve vibrations perpendicular to the plane. Of the 20, 14 should be Raman-active, 10 infra-red-active (7 com-

mon with Raman active), and 3 inactive in both spectra. $B_3N_3H_6$ is iso-electronic with C_6H_6; similarities between the symmetry classes of their normal vibrations are illustrated. A normal co-ordinate treatment has been carried out to determine the force consts., to assist in the assignment of fundamentals, and to permit calculation of the three inactive vv. Ascertained vv are assigned and compared with those of C_6H_6. From the comparison the assignment of the frequencies of C_6H_6 made by Lord and Andrews (A., 1939, I, 175) is preferred to that made earlier (A., 1936, 1322). A Raman displacement of 938 cm.$^{-1}$ has high-frequency satellites attributable to mols. containing ^{10}B; the magnitude of isotopic shifts has been calc. From the assignments made, thermodynamic properties of $B_3N_3H_6$ from 298·1° to 1000° K. have been calc. and, combined with v.p. data, yield $S^\circ_{298} (l) = 51\cdot0$, $S^\circ_{326} (l) = 53\cdot4$ (b.p., 326° K.), $[(F^\circ - E_0^\circ)/T]_{298} (l) = -62\cdot5$ g.-cal./mol./degree.
W. R. A.

New Coriolis perturbation in the methane spectrum. III. Intensities and optical spectrum. W. H. J. CHILDS and H. A. JAHN (Proc. Roy. Soc., 1939, A, 169, 451—463; cf. A., 1939, I, 119).—The explanation of the fine structure of the infra-red absorption band of CH_4 at 1306 cm.$^{-1}$, in terms of a tetrahedral mol., is completed. The theoretical spectrum agrees well with observation. The structural complexity of the overtone band at 9047 cm.$^{-1}$ is explained.
G. D. P.

Vibrational assignments in ethane. E. F. BARKER (J. Chem. Physics, 1939, 7, 277).—For H bond deformation frequencies an assignment alternative to that given by Crawford et al. (A., 1939, I, 8) is proposed.
W. R. A.

Infra-red absorption spectra and approximate force constants of propene and allene. L. G. BONNER and R. HOFSTADTER (Physical Rev., 1937, [ii], 52, 249).—Under pressure conditions ranging from 35—700 mm. gaseous C_3H_6 shows bands at 6211, 4386, 3021, 2309, 2008, 1815, 1634, 1435, 1183, 984, and 906 cm.$^{-1}$, and allene at 6289, 4525, 3086, 2392, 1961, 1678, 1381, 1143, 1033, and 840 cm.$^{-1}$ Approx. force consts. calc. for C:C are 10·0 and 9·54 × 10^5 dynes per cm. from C_3H_6 and allene, respectively. For propene, the C·C force const. is 3·8 × 10^5 dynes per cm.
L. S. T.

Infra-red and Raman spectra of molecules. A. CICCONE (Nuovo Cim., 1938, 15, 482—521).—A comprehensive review of the theory of infra-red and Raman spectra and of their application in investigating the structure of di- and poly-at. mols.
O. J. W.

Infra-red absorption spectra of high mol. wt. hydrocarbons and of some heterocyclic compounds. P. LAMBERT and J. LECOMTE (Compt. rend., 1939, 208, 1148—1150).—The infra-red absorption spectra (525—1400 cm.$^{-1}$) of two groups of related compounds, obtained in CS_2 solution, in thin solid layers, or in powder form, have been compared : (a) indene (I), indole, coumarone, thionaphthen (II), and hydrindene; (b) anthracene (III), 2-methylanthracene (IV), 2 : 3-benzanthracene (V), acridine (VI), xanthine (VII), and thiodiphenylamine (VIII).

The majority of the bands do not undergo displacement on passing from (I) to (II); a notable exception is the strong 714 cm.$^{-1}$ band of (I) which is displaced to 562 cm.$^{-1}$ Owing to the presence of polymerisation products (II) shows many more bands than the others. For all the mols. in (a) the infra-red max. correspond generally with weak Raman displacements and vice versa. (III) and (V) have D_{2h} symmetry; this explains the correspondence of the lines observed in their spectra. (IV), however, which has a plane of symmetry, also exhibits this correspondence. (VI), (VII), and (VIII) have symmetry C_{2v}, and their absorption spectra therefore show max. corresponding with this symmetry as well as those of (III) to which they are chemically related.
W. R. A.

Absorption spectra of fats in the infra-red region. V. G. VAFIADI (J. Gen. Chem. Russ., 1938, 8, 1447—1453).—A no. of fats (natural and hardened) were studied, for λλ 1—9 μ. The results suggest that the no. of OH groups falls during polymerisation, but rises during oxidation.
R. T.

Fine structure of residual rays. M. BLACKMAN (Z. Physik, 1939, 112, 256; cf. A., 1934, 3).—A correction.
L. G. G.

Raman effect in relation to crystal structure. S. BHAGAVANTAM and T. VENKATARAYUDU (Proc. Indian Acad. Sci., 1939, 9, A, 224—258).—A theory of normal oscillations of crystal lattices is developed and appropriate selection rules for Raman and infrared spectra are given. The theory is applied to typical cubic (diamond, rock-salt) and trigonal crystals (calcite, $NaNO_3$, corundum) and, for comparison, aragonite and KNO_3. In crystals of low symmetry (e.g., gypsum and anhydrite) splitting of degenerate modes occurs. Comparison of the Raman spectra of free mols. and the corresponding crystals of Hg_2Cl_2 is made. The directional excitation of Raman effect in calcite and $NaNO_3$ is discussed. The low-frequency " wings " observed with solid org. substances are lattice oscillations, either translational or rotational, and can be explained without postulating any special mechanism.
W. R. A.

Raman effect and the potential function of the ethylene molecule. M. DE HEMPTINNE and C. MANNEBACK (Proc. Indian Acad. Sci., 1939, 9, A, 286—302).—A review of existing theories and experimental data, and an extension in which account is taken of interaction terms in the potential function and of anharmonicity. The spectra of the various isotopic analogues are discussed.
W. R. A.

Measurements of intensity of some Raman lines. M. KOWALEWSKI (Acta Phys. Polon., 1939, 7, 279—284).—The relative intensities of Raman lines from CS_2, CCl_4, $CHCl_3$, CH_2Cl_2, and C_2Cl_4 have been measured by a microphotometer method. There is no simple relation between the intensity and the nature of the vibrations concerned; some of the results are not in agreement with those predicted from empirical rules.
J. A. K.

Raman effect in difluorochloromethane. G. GLOCKLER and J. H. BACHMANN (Physical Rev., 1939, [ii], 55, 669).—Data for 13 Raman shifts at −55° are reported.
N. M. B.

Raman effect of fluorotrichloromethane. G. GLOCKLER and G. R. LEADER (J. Chem. Physics, 1939, **7**, 278—279).—At ~0° $CFCl_3$, when excited by eight concentric Ne–Hg lamps, exhibits Raman displacements of 243·7, 349·5, 397·5, 535·3, 833·2, and 1067·2 cm.$^{-1}$ W. R. A.

[Raman] spectra of β-tetralone and β-indanone. D. BIQUARD (Compt. rend., 1939, **208**, 1096—1098; cf. A., 1938, I, 435).—The Raman line characteristic of C:O is feebler than in the α-isomerides, due to the CH_2 which separates the aromatic ring from CO. The absorption spectra are found nearer the ultraviolet in the β- than in the α-compounds.
J. L. D.

Raman effect of certain cyclanones. M. GODCHOT and (MLLE.) G. CAUQUIL (Compt. rend., 1939, **208**, 1065—1067).—The Raman spectra of cycloheptanone, 4-methyl- and 2-ethyl-cycloheptanones, cyclooctanone and methylcyclooctanone, acetylcyclohexane, and 5-acetyldimethylcyclohexanes are recorded and discussed. W. R. A.

Luminescence of water when subjected to ultrasonic vibrations. I. G. POLOTZKI (J. Gen. Chem. Russ., 1938, **8**, 1691—1695).—Exposure to ultrasonic vibrations of H_2O saturated at 1 atm. with air, N_2, or O_2, but not with H_2 or CO_2, or at pressures of 10 or 1140 mm., caused luminescence, of which about half was in the ultra-violet region. In the case of air, the H_2O contained finally HNO_2 0·166, HNO_3 0·159, and H_2O_2 0·151 mg.-%. R. T.

Influence of an electric field on the shape of emission bands in electro-photo-luminescence. G. DESTRIAU and LOUDETTE (Compt. rend., 1939, **208**, 891—893).—The intensity (I) of the photo-luminescence excited by an electric field is related to the effective applied sinusoidal potential (V) by $I = Ae^{-B/V}$. The coeff. A is const. but B varies with λ. For ZnS–Mn and ZnS–CdS phosphors emission becomes stronger at short λλ, the corresponding bands becoming deformed and displaced towards shorter λ, whilst for ZnS–Cu phosphors the reverse holds. J. W. S.

Spectral variation of the photosensitivity of visual purple. E. E. SCHNEIDER, C. F. GOODEVE, and R. J. LYTHGOE (Proc. Roy. Soc., 1939, **A, 170**, 102—112).—The bleaching of visual purple was studied in the range 4200—5600 A. It is concluded that the quantum efficiency, i.e., the no. of chromophoric groupings decomposed per quantum absorbed, is approx. unity. The bearing of the results on the relation between visual purple and scotopic vision is discussed. G. D. P.

Fluorescence of compounds containing manganese. J. T. RANDALL (Proc. Roy. Soc., 1939, **A, 170**, 272—293).—A large no. of compounds has been investigated at temp. between 90° and 20° K. The fluorescence spectrum was recorded by a quartz spectrograph, both ultra-violet light and cathode rays being used to excite fluorescence. In the pure Mn halides the red fluorescence is a property of all Mn atoms in the crystals. Four classes of solids containing Mn as impurity are recognised. G. D. P.

Luminescence and absorption of ZnS–MnS mixed crystals. F. A. KRÖGER (Physica, 1939, **6**, 369—379).—Measurements of absorption and emission of ZnS crystals containing 0·1—50% MnS, illuminated in the visible and near ultra-violet, have been made at room temp., −180°, and −253°. An absorption band system practically identical with that of pink MnS is found at all compositions, together with two band systems identical with those of pure ZnS. Illumination in the latter regions gives both phosphorescence and fluorescence, in the former only fluorescence. All emission observed is in two bands, with maxima 5850 and ~6200 A., ascribed to two electronic transitions in Mn^{++}. The effects of temp. and activator concn. on emission intensity are recorded. L. J. J.

Chemiluminescence of organic compounds. H. H. HATT (J. Proc. Austral. Chem. Inst., 1939, **6**, 88—101).—A lecture.

Chemiluminescence of dimethyldiacridylium nitrate. B. TAMAMUSHI and H. AKIYAMA (Trans. Faraday Soc., 1939, **35**, 491—494).—The luminescence of dimethyldiacridylium nitrate (I) in alkaline solution increases rapidly with rise of temp., but is extinguished in absence of O_2. The luminescence is connected with a reduction reaction, since it appears strongly on addition of a reducing agent, provided that the solution has first undergone oxidation. The fact that OsO_4 and PbO_2 intensify the luminescence occurring when (I) is oxidised by H_2O_2 is attributed to reaction with H_2O_2 and consequent rise of temp. It is suggested that at higher temp. a free radical is formed and undergoes oxidation by mol. O_2 to an unstable peroxide. The reduction of this peroxide to (I) by H_2O_2 or other reducing agent is attended by the luminescence. J. W. S.

Phosphorescence, self-extinction, and sensitising action of organic substances. H. KAUTSKY and H. MERKEL (Naturwiss., 1939, **27**, 195—196).—Org. substances capable of fluorescence may also be made to phosphoresce under certain conditions of interaction between excited and unexcited mols. (collision, association). Examples of various systems which illustrate this are given. In systems of high fluorescence efficiency, the org. substance is predominantly in the unimol. state. Increase of pressure, or adsorption, gives increased phosphorescence in these systems, since it increases the frequency of collision and association. In systems which fluoresce only slightly the mols. are usually associated in dil. solution. Increase in concn. usually diminishes the phosphorescence so that a small degree of association seems to favour phosphorescence. At low temp. the phosphorescence is of longer λ than the fluorescence. At room temp. the two may become the same if the energy difference between the two types of emission can be accounted for by thermal collision. In this case phosphorescence can be converted into fluorescence by slight warming. The sudden change of long-λ phosphorescence into short-λ fluorescence may be brought about by the rapid addition of O_2 to an evacuated phosphorescing adsorbate. The formation of fluorescing products by photochemical reaction, and sensitisation, are considered. A. J. M.

Quantitative treatment of photo-electric primary and secondary currents. R. HILSCH and R. W. POHL (Z. Physik, 1939, **112**, 252—255).—Corrections are applied to previous work (A., 1938, I, 120).   H. C. G.

Variation of the electrochemical potential in the cuprous oxide rectifier. E. LANGE (Physikal. Z., 1939, **40**, 230—232).—The change in the electrochemical potential in a Cu_2O rectifying film with electron defect is considered.   A. J. M.

Volta contact e.m.f. J. NICOL (Proc. Physical Soc., 1939, **51**, 550).—A single Au leaf is suspended from an insulated rod and cap so as to hang exactly mid-way between the upturned ends of Cu and Zn strips connected externally. On approaching an ebonite/fur rod to the cap the leaf moves towards the Zn ; a glass/silk rod causes movement towards the Cu.   N. M. B.

Theory of [electrical] breakdown. W. ROGOWSKI (Naturwiss., 1939, **27**, 302—303).—The relationships to be expected in a discharge when the production of back electrons is due to surface ionisation of positive ions (γ-effect), or to photo-electric action (ϵ-effect), or to a combination of the two, are discussed (cf. A., 1938, I, 108).   A. J. M.

Breakdown voltage in mercury vapour. B. KLARFELD and L. GUSJEVA (Tech. Phys. U.S.S.R., 1938, **5**, 425—430).—The ignition of a discharge between plane Ni electrodes in Hg vapour has been investigated for vals. of $p_0.d$ (*i.e.*, v.p. reduced to 0° × distance between plates) less than that corresponding with the min. ignition p.d. It has been found that at a crit. val. of p_0d the ignition p.d. suddenly becomes 10—15 times as large. The shape of the experimental breakdown curve is explained by the way in which the no. of electrons released from the cathode at the impact of each positive ion depends on the velocity of the latter.   T. H. G.

Effect of temperature on electric currents in paraffin. W. SCILOWSKI (Acta Phys. Polon., 1939, **7**, 214—230).—The electrical conductivity of paraffin has been studied from 17° to 45°. Measurements of current–time and current–potential and the effect of irradiation with γ- and X-rays are recorded. The results obtained are complicated by the existence simultaneously of two conduction processes, and by the fact that the initial and later currents are not affected in the same way by temp.   J. A. K.

Effect of molecular form on dielectric relaxation. A. BUDÓ, E. FISCHER, and S. MIYAMOTO (Physikal. Z., 1939, **40**, 337—345).—The effect of the shape of the mol. and the position of its dipoles on the dielectric relaxation time has been investigated. The dielectric loss of dil. solutions of o-$C_6H_4Cl_2$, and 1 : 8- and 2 : 3-dichloroanthraquinone in C_6H_6 was determined. The 2 : 3-derivative has a greater loss than the 1 : 8-derivative although it has a smaller moment. The dielectric loss varies linearly with concn. The above mols. are ellipsoidal and differ from each other in the direction of the moment with respect to the axis of the ellipsoid. The results agree with those obtained by calculation based on Perrin's theory. A short

derivation of the Perrin formula, corresponding with the Debye derivation for spherical mols., is given.   A. J. M.

Dielectric relaxation of molecules with dipole groups capable of free rotation. E. FISCHER and F. C. FRANK (Physikal. Z., 1939, **40**, 345—352).—The effect of the presence of freely rotatable polar groups on the magnitude of the dielectric relaxation time has been determined for p-xylylene dichloride and dibromide and CH_2PhCl. Improved thermostatic methods were used. The relaxation times of the above mols. which contain groups capable of free rotation are < those of mols. of approx. the same size with fixed dipoles (*e.g.*, o- and p-$C_6H_4Cl_2$). The effect can be explained by the introduction of two viscosity factors, one covering the rotation of the whole mol., the other that of the rotating group. Experimental vals. of these factors agree well with the magnitudes of the mol. and polar groups.   A. J. M.

Dielectric constants of ammonium chloride and fluoride at the transition points. R. SCHULVAS-SOROKINA and V. JEVDOKIMOV (Tech. Phys. U.R.S.S., 1938, **5**, 473).—It is suggested that the transition points of polymorphous salts due to changes of structure are associated with the radii of the elements. For the NH_4 halides they should be proportional only to the radii of the anions since the radius of the cation is const. This relationship was found to hold for NH_4I, NH_4Br, and NH_4Cl. Extrapolation indicates that NH_4F should have a transition point at —27°. This has been observed experimentally by investigating the variation of ϵ with temp. using the high-frequency bridge method. At —30° ϵ_{NH_4Cl} increases sharply by 10% and at —27° that of NH_4F by 25%.   T. H. G.

Dielectric polarisation. W. HÜCKEL (Österr. Chem.-Ztg., 1939, **42**, 161—168).—A lecture.

Vapour-phase electric dipole moments of thionyl chloride, sulphuryl chloride, dimethyl sulphone, and thiophosgene. I. E. COOP and L. E. SUTTON (Trans. Faraday Soc., 1939, **35**, 505—511).—From measurements of the dielectric consts. of the vapours over wide temp. ranges the dipole moments (μ) of $SOCl_2$, SO_2Cl_2, Me_2SO_2, and $CSCl_2$ are found to be 1.44 ± 0.005, 1.795 ± 0.005, 4.44 ± 0.1, and 0.28 ± 0.02 D., respectively. The at. polarisations of $SOCl_2$ and SO_2Cl_2 are 3—4 c.c. and 4.1—5.7 c.c., respectively, corresponding with 13.5—20 and 19—27% of the electron polarisation, respectively. The higher vals. obtained from solution measurements (Smith, A., 1932, 1190) may be due to the small temp. range used. Comparison of the vals. of μ for $SOCl_2$ and Me_2SO_2 provides no support for the view that $SOCl_2$ and SO_2Cl_2 are resonance hybrids similar to $COCl_2$. μ for $CSCl_2$ is < for $COCl_2$. The reasons for this are discussed.   J. W. S.

Dipole moments of *cis*- and *trans*-azobenzenes and of some related compounds. G. S. HARTLEY and R. J. W. LE FÈVRE (J.C.S., 1939, 531—535).—Dielectric-polarisation data for *cis*- and *trans*-$(NPh)_2$, p-$(N\cdot C_6H_4Me)_2$ (I), and benzene- and toluene-azo-β-naphthol in C_6H_6 solution at 25° are recorded. The data for $(NPh)_2$ indicate that the equilibrium composition in sunlight corresponds with 22% of *cis*- and

78% of *trans*-compound. The moment of (I) is ~0 but it increases under the influence of sunlight; the normal compound is, therefore, the *trans*-form. In the case of the two dyes no evidence of photochemical inversion has been obtained.   C. R. H.

Dielectric polarisation data for the allegedly isomeric 4 : 4'-dihydroxyazobenzenes of Willstätter and Benz. I. DOSTROVSKY and R. J. W. LE FÈVRE (J.C.S., 1939, 535—537).—The moments of both forms in dioxan solution appear to be identical and of the order to be expected for the *trans*-modification.   C. R. H.

Dipole moments, especially of anthraquinone derivatives, with reference to the inner molecular induction effect. E. FISCHER and F. ROGOWSKI (Physikal. Z., 1939, **40**, 331—337).—The dipole moments of 1- and 2-chloro- and 2 : 3- (I) and 1 : 8-dichloro-anthraquinone have been determined in dil. solution in C_6H_6, dioxan, and $COMe_2$. The vals. calc. by vector addition from the C–Cl moment of PhCl do not agree with the observed vals., but the deviations can be explained by the moment induced by a C·Cl linking attached to the C_6H_6 ring in the remainder of the mol. In (I) the C_6H_6 ring bearing the two Cl shows the same *o*-effect as in *o*-$C_6H_4Cl_2$. The dipole moments of anthraquinone, *o*-$C_6H_4Cl_2$, *o*-$C_6H_4Br_2$, *p*-xylylene dichloride and dibromide in C_6H_6 are also recorded.   A. J. M.

Dipole moment and configuration of arsenobenzene. R. J. W. LE FÈVRE and C. A. PARKER (J.C.S., 1939, 677).—Arsenobenzene has a very small moment and consequently the mol. is symmetrical and, by analogy with stable $(NPh)_2$, is the *trans*-form.   C. R. H.

Molecular volumes in crystallo-chemistry. I. I. ZASLAVSKI (J. Gen. Chem. Russ., 1938, **8**, 1008—1021).—The distance d between the atoms of crystals is expressed by $d = k(v/n)^{\frac{1}{3}}$, where $k = 1·326$ for metals and inert gases, 0·9—1·2 for semi-metals (Si, Ge, As, Se, Sn, etc.), 0·3—0·9 for metalloids (H, N, O, P, S, Cl, etc.), and 1·045—1·290 for various cryst. types, v is the mol. or at. vol., and n is the no. of atoms in the mol. The crystal type of series of salts is a function of v, changing from one type to another when v exceeds a certain crit. val. Salts having a crit. val. of v tend to exhibit polymorphism.   R. T.

Refractive index of methane in the infra-red. R. ROLLEFSON and R. J. HAVENS (Physical Rev., 1937, [ii], **52**, 249).—The n of CH_4 has been measured from 1 to 15 μ. The variation of n in the neighbourhood of the 3·3 and 7·7 μ. bands shows the ratio of the intensities of these bands to be ~2·3.   L. S. T.

Refraction and dispersion of liquid phosphorus. T. PIECH and T. NAYDER (Bull. Acad. Polonaise, 1939, A, 428—437).—Vals. from 44° to 65° and various λλ are recorded and discussed. For n_D the val. is given by $n = 2·11038 - 0·000790$.   W. R. A.

Theory of optical activity. E. U. CONDON, W. ALTAR, and H. EYRING (Physical Rev., 1937, [ii], **52**, 254).—A single electron moving quantum-mechanic-

ally in a field of suitable dissymmetry suffices to make a medium containing such mols. show optical activity.   L. S. T.

Analysis of the rotatory dispersion of tartaric acid and a view on the origin of its optical activity. Optical activity and chemical structure in tartaric acid. VII. Y. TSUZUKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 425—434).—The optical rotatory dispersions in the visible region of dicinnamoyl- (I), dibenzoyl- (II), and di(phenylacetyl)-tartaric anhydride (III) in dioxan have been measured and are shown to be simple; their dispersion ratios, α 4358/α 5461, and characteristic λ are respectively, 2·284, 1·845, 1·818 and 3253, 2545, 2447 A. Absorption spectra measurements in the ultra-violet show absorption max. at 2840 A. for (I) and 2700 A. for (II); the complete absorption band for (III) could not be measured, but the max. is estimated to be <2660 A. The results indicate that the positive partial rotation of tartaric acid and its derivatives is due to the contribution of the OH and the negative partial rotation to the CO_2H.   D. F. R.

Optical rotatory powers of (+)-γ-methyl-*n*-heptane.—See A., 1939, II, 238.

Theory of the Cotton–Mouton effect in quantum mechanics. T. NEUGEBAUER (Z. Physik, 1939, **112**, 257—277).—Theoretical.   L. G. G.

Thermal variation of the magnetic birefringence of polar liquids. A. PIEKARA (Compt. rend., 1939, **208**, 1150—1152).—Theoretical (cf. *ibid.*, 990).   W. R. A.

Structure of the so-called " alkali tetroxides." A. HELMS and W. KLEMM (Z. anorg. Chem., 1939, **241**, 97—106).—The results of Kassatotschkin and Kotov (A., 1936, 1054) on the crystal structure of K " tetroxide " have been confirmed, and the corresponding Rb and Cs compounds found to have also the CaC_2 structure. They are to be formulated KO_2, RbO_2, and CsO_2, and to be designated " dioxides." The lattice consts. are as follows : KO_2 a 5·70, c 6·75 A.; RbO_2, a 6·00, c 7·03 A.; CsO_2, a 6·28, c 7·24 A. They have ρ = 2·15, 3·06, and 3·80, respectively, and for RbO_2 and CsO_2 $10^6\chi = 42·2$ at $-183°$ and 13·0 at 20°, and 27·3 at $-183°$ and 9·3 at 20°, giving mol. moments ~1·9, in agreement with the val. for KO_2 (A., 1936, 148). The configurations, crystal radii, and mol. vols., of the O_2^{1-} and O_2^{2-} ions are compared.   F. J. G.

Spatial configuration of platinous and palladous complexes. K. A. JENSEN (Z. anorg. Chem., 1939, **241**, 115—133).—The principal evidence in favour of the non-planar configuration is the work of Reihlen *et al.* (A., 1931, 924, 1167; 1933, 74; 1935, 1132; 1936, 84); some of this has been repeated. The experimental result, that *bis*-(3-methyl-2-amino-methyl-4-ethylquinoline)-Pt^{II} bromocamphorsulphonate has a lower rotation than that calc. from its bromocamphorsulphonate content, is confirmed, and it is shown that when the Pt^{II} complex is pptd. as picrate or platinichloride the rotation of the filtrate rises to the calc. val., but on the other hand a similar increase of the rotation to the calc. val. is brought about,

without pptn., by addition of anions which form stable Pt^{II} complexes. It follows that the low rotation of the bromocamphorsulphonate is to be explained by its containing complex-bound bromocamphorsulphonate ions, and not by optical acitvity of the complex Pt^{II} cation. The nature of the suggested bromocamphorsulphonato-complex, and evidence for its presence, are discussed, and also the possibility of alternative interpretations of other results of Reihlen. It is concluded that there now remains no valid evidence in favour of the non-planar configuration for Pt^{II} and Pd^{II} complexes.   F. J. G.

Determination of force fields from scattering in the classical theory. F. C. HOYT (Physical Rev., 1939, [ii], **55**, 664—665).—Mathematical.
                                                        N. M. B.

Quantum-mechanical calculation of the lattice energy of sodium chloride. R. LANDSHOFF (Physical Rev., 1937, [ii], **52**, 246).—Using a wave function in the form of a determinant of single-electron wave functions, the calc. lattice energy of the NaCl crystal is 182 kg.-cal. per mol., and the lattice distance 2·78 A.   L. S. T.

Calculation of equilibrium internuclear distances for diatomic hydrogen, hydrides, and deuterides in ground and excited states. C. H. D. CLARK and J. L. STOVES (Phil. Mag., 1939, [vii], **27**, 389—403).—Equilibrium internuclear distances of a no. of hydride di-atoms have been calc., using four previously suggested formulæ. The vals. are compared with each other and with experimental data. HH, HD, DD, and various deuterides have been treated by the same method and the influence of isotopes is discussed.   W. R. A.

Calculation of the frequencies and " gauches " fundamental modes of vibration of molecules of deuterethylene, $C_2H_xD_y$ ($x + y = 4$). E. BERNARD and C. MANNEBACK (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 113—124).—In previous calculations the " gauches " frequencies (i.e., those perpendicular to the plane of the mol.) have been neglected. These have now been calc. for C_2H_4, C_2D_4, C_2H_3D, C_2HD_3, and cis-, trans-, and as-$(CHD)_2$.   W. R. A.

Calculation of the potential functions and fundamental frequencies of the molecules, $C_2H_xD_y$ ($x + y = 4$). Y. L. TCHANG (Ann. Soc. Sci., Bruxelles, 1939, [i], **59**, 125).—Errata (cf. A., 1938, I, 299).   W. R. A.

Theory of liquid structure. J. HIRSCHFELDER, D. STEVENSON, and H. EYRING (Physical Rev., 1937, [ii], **52**, 246).   L. S. T.

Nature of foam. IV. Phase inversion and foaming of emulsions consisting of acetic acid, ethyl ether, and water. T. SASAKI (Bull. Chem. Soc. Japan, 1939, **14**, 63—72; cf. A., 1939, I, 141, 196).—The heterogeneous system $AcOH–Et_2O–H_2O$ is divided into three parts, oil-in-water region (i), water-in-oil region (ii), and phase inversion zone (iii). Frothing occurs in (ii) but not in (i). In (iii) either (i) or (ii) may be produced, according to the method of shaking.   D. F. R.

Organic parachors. (II) Temperature and (III) constitutive variations of parachors of a series of tertiary alcohols. (MISS) K. OWEN, O. R. QUAYLE, and E. M. BEAVERS (J. Amer. Chem. Soc., 1939, **61**, 900—905; cf. A., 1939, I, 11).—γ and parachors are determined for 16 tert.-alcohols at 25°, 35°, 45°, 55°, and 65°. The parachors increase $\sim 0.2\%$ for each rise of 10°. Vals. are calc. for CH_2 substituted in each position of $CRR'R''\cdot OH$; the vals. are more regular as the chain becomes longer, i.e., the constitutive effect is the greater, the nearer the alcohol is to $Bu^\gamma OH$.   R. S. C.

Derivation of the formula for the total scattering of X-rays from a general crystal. G. G. HARVEY (Physical Rev., 1937, [ii], **52**, 248).—A formula for the intensity of total scattering of X-rays in any direction has been derived for a general triclinic crystal having any no. of atoms in the unit cell.   L. S. T.

Diffusion of X-rays by crystals and microcrystalline materials. A. GUINIER (Compt. rend., 1939, **208**, 894—896).—The coeff. of diffusion has been measured for various angles ($\not> 45°$) after passage through diamond, graphite, Al, Cu, Ag, Ni, and Au. No discontinuities are detectable in the diffusion curve. Contrary to theory, diffusion increases near diffraction lines and does not become zero at very low diffusion angles.   J. W. S.

Significance of crystal habit. J. D. H. DONNAY (Amer. Min., 1938, **23**, 168—169).—A discussion.
                                                        L. S. T.

Structure of polished metallic surfaces. S. DOBIŃSKI (Physikal. Z., 1939, **40**, 232—233).—A reply to Plessing (A., 1938, I, 503). The difference between the results of Dobiński (A., 1937, I, 227) and those of Plessing cannot be due to insufficient formation of the polished surface under C_6H_6. The reversibility of the process of oxidation of a metal, $M_x + O_y \rightleftharpoons M_xO_y$, is discussed.   A. J. M.

Structure of polished metallic surfaces. E. PLESSING (Physikal. Z., 1939, **40**, 233—234).—A reply to Dobiński (preceding abstract). Further experiments uphold the previous conclusion that the difference in the X-ray diagrams of metals polished in air and below C_6H_6 is not due to oxidation.
                                                        A. J. M.

Crystal growth of sodium chloride on galena. M. C. F. BEUKERS (Rec. trav. chim., 1939, **58**, 435—447).—The orientation of NaCl cryst. on a cleavage face of galena which had been treated in various ways, e.g., etched, polished, or roughened, has been observed microscopically and compared with electron diffraction patterns of the surface prior to crystallisation. Good orientation of NaCl generally occurred on surfaces showing a definite diffraction pattern.   C. R. H.

Iron crystal orientation on magnetite reduced by hydrogen. N. BUINOV, M. JURAVLEVA, A. KOMAR, and G. TSCHUFAROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 27—28).—At 500° the (001) axes of the Fe_3O_4 and Fe crystals are parallel. The Fe orientation disappears on prolonged reduction.
                                                        L. J. J.

X-Ray study of lattice distortion in copper, nickel, and rhodium. G. W. BRINDLEY and P. RIDLEY (Proc. Physical Soc., 1939, **51**, 432—448; cf. A., 1938, I, 439).—The nature of lattice distortion in filed powders of Cu, Ni, and Rh, face-centred cubic metals, is investigated with reference to measurements of widths and intensities of X-ray reflexions. The effect of extinction on the reflected intensities is discussed in detail and from the magnitude of the extinction mean crystal sizes are estimated. Lattice distortion causes a decrease of reflected intensity, becoming more marked in the order $Rh \rightarrow Ni \rightarrow Cu$; the broadening of the reflexions increases in the reverse direction, which is that of increasing hardness. Results are discussed in relation to lattice distortion theories. It is shown that with distortions of a non-periodic type, changes of reflected intensity may occur as a result of irregular displacements of the atoms and a broadening may occur as a result of a change in the mean crystal parameter throughout an entire grain. Vals. of the lattice energies associated with these changes are calc. and compared with vals. obtained by direct methods; results indicate that the energy of a distorted metal resides mainly in the at. displacements rather than in macroscopic stresses extending over entire grains.   N. M. B.

Crystal structures of metallic scandium. K. MEISEL (Naturwiss., 1939, **27**, 230).—Debye diagrams obtained with metallic Sc show the existence of both a cubic close-packed, and a hexagonal close-packed, lattice. The former has a 4.532 ± 0.005 A., ρ 3.20 ± 0.01, at. vol. 14.1; the latter, a 3.30 ± 0.01 A., c 5.23 ± 0.01 A., ρ 3.02 ± 0.04, at. vol. 14.9. Sc fits in satisfactorily with its neighbours in the periodic system as regards cryst. structure.   A. J. M.

Crystal structure of palladous chloride, $PdCl_2$. A. F. WELLS (Z. Krist., 1938, **100**, 189—194).—By X-ray analysis, the rhombic cell has a 3.81, b 3.34, c 11.0 A.; $\rho_{calc.}$ 4.20; 2 mols. per cell; space-group $Pnmn$—D_{2h}^{12}. Complete at. parameters and interdistances yield a novel structure, according with cleavage, n, and X-ray intensities, of plane $(PdCl_2)_\infty$ chains (rhombus links; Pd—Cl 2.31 A., axial angle Cl–Pd–Cl 87°) parallel to b and packed like the C-chain skeleton in rhombic n-paraffins. Inter-chain distance (Cl—Cl) is 3.65 A.   I. McA.

Crystal structure of K_2HgCl_4,H_2O. C. H. MACGILLAVRY, J. H. DE WILDE, and J. M. BIJVOET (Z. Krist., 1938, **100**, 212—220).—By X-ray analysis, the rhombic cell containing 4 mols. has a 8.27, b 11.63, c 8.89 A.; ρ 3.39; space-group $Pbam$. General considerations and detailed analysis of rotation, oscillation, and Sauter X-radiograms yield complete at. parameters. The structure consists of deformed $HgCl_6$ octahedra (confirming $HgCl_2$ mols.) sharing edges to form " towers " linked by K and H_2O. The K atoms have different functions in the structure. The rôle of Hg in simple and complex salt halides is reviewed.   I. McA.

Crystal structure of cubic yttrium fluoride, YF_3. W. NOWACKI [with appendix by G. BECK and W. NOWACKI] (Z. Krist., 1938, **100**, 242—250).— YF_3 pptd. by NaF has ρ 4.02 (cf. A., 1938, I, 440).

Statistical at. distributions are discussed on the basis of indexed estimated X-ray intensities. YF_3 pptd. by HF gives a stable non-cubic form (ρ 5.2) persisting on heating at 800—1000°. From chemical and X-ray analyses, YF_3 in molten NaF forms the *compound* $NaYF_4$, ρ 4.21.   I. McA.

Crystal structure of the bromostannates A_2SnBr_6. ($A = Cs, Rb, NH_4, K$). G. MARKSTEIN and H. NOWOTNY (Z. Krist., 1938, **100**, 265—271; cf. Ketelaar, A., 1937, I, 604).—From single-crystal and powder X-ray analysis, the Cs, Rb, and NH_4 salts are face-centred cubic with a 10.81, 10.64, and 10.59 A., respectively; $Z = 4$; ρ 4.52, 4.21, and 3.54, respectively. The K salt is pseudo-cubic tetragonal with a 7.43, c 10.61 A.; ρ 3.81; probable space-group D_4^2—$C422_1$. At. parameters determined show slight deviation in at. interdistances from theory; these are discussed in terms of co-ordination no., and ionic size and form.   I. McA

Sulphates of the magnesium series. M. DELÉPINE and P. LEBEAU (Ann. Chim., 1939, [xi], **11**, 247—358).—The sulphates of the series Mg, Mn, Fe, Co, Ni, Cu, Zn, and their hydrates, have been studied by means of X-rays. The great similarity of the powder photographs for the salts of each type shows that the well-known isomorphism of the higher hydrates extends to the lower hydrates and the anhyd. salts. $MnSO_4,3.5H_2O$ is described. The following parameters are recorded. $MgSO_4,6H_2O$, a 10.0, b 7.10, c 24.0 A.; $CoSO_4,6H_2O$, a 9.90, b 7.10, c 23.8 A.; $NiSO_4,6H_2O$, a 9.90, b 7.07, c 23.8 A.; $ZnSO_4,6H_2O$, a 9.95, b 7.05, c 24.0 A. (all have 8 mols. in the unit cell; $MnSO_4,5H_2O$, a 6.2, b 10.7, c 6.1 A. (with 2 mols. in the unit cell); $MgSO_4,4H_2O$, a 5.89, b 13.6, c 7.73 A.; $MnSO_4,4H_2O$, a 5.97, b 13.8, c 7.87 A.; $FeSO_4,4H_2O$, a 5.90, b 13.5, c 7.74 A.; $CoSO_4,4H_2O$, a 5.82, b 13.3, c 7.60 A.; $NiSO_4,4H_2O$, a 5.80, b 13.2, c 7.65 A.; $ZnSO_4,4H_2O$, a 5.86, b 13.4, c 7.75 A. (all with 4 mols. in the unit cell); $MgSO_4,H_2O$, a 6.81, b 7.71, c 13.3 A.; $MnSO_4,H_2O$, a 6.74, b 8.10, c 13.3 A.; $FeSO_4,H_2O$, a 6.71, b 8.03, c 13.0 A.; $CoSO_4,H_2O$, a 6.60, b 7.87, c 12.8 A.; $NiSO_4,H_2O$, a 6.57, b 7.80, c 13.0 A.; $CuSO_4,H_2O$, a 6.80, b 7.90, c 12.6 A.; $ZnSO_4,H_2O$, a 6.64, b 7.80, c 13.2 A.; (all with 8 mols. in the unit cell); $MgSO_4$, a 4.82, b 6.72, c 8.35 A.; $MnSO_4$, a 4.86, b 6.81, c 8.58 A.; $FeSO_4$, a 4.82, b 6.81, c 8.67 A.; $CoSO_4$, a 4.65, b 6.66, c 8.46 A.; $NiSO_4$, a 4.62, b 6.51, c 8.49 A.; $CuSO_4$, a 4.88, b 6.66, c 8.32 A.; $ZnSO_4$, a 4.71, b 6.73, c 8.51 A. (all with 4 mols. in the unit cell). From the parameters the mol. vol. is calc., and it is shown that vals. so obtained are more reliable than those based on pyknometric determinations of ρ. The mol. vols. of the anhyd. salts and of the hydrates of each type increase in the order Ni, Co, Cu, Zn, Fe, Mg, Mn. The apparent mol. vol. of the H_2O increases from ~11 c.c. for the first mol. to ~18 c.c. for the seventh, but the increase is not linear. The square root of the mol. vol. of a hydrate is a linear function of the no. of H_2O mols. The crystal parameters of the whole series of anhyd. salts and hydrates are all ~ one of four fundamental parameters or an integral multiple of one of them. These are 5.0 A. (P), 6.0 A. (Q), 6.7 A. (R) and 7.7 A. (S). R occurs in all the anhyd. salts and all hydrates

except the pentahydrate, and also in Ca, Sr, Ba, and Pb sulphates, but not in other salts of the Mg series nor in sulphates of other valency-types. It is associated with the group $M^{II}SO_4$. P occurs in the anhyd. salt and in some of the hydrates, and also in a no. of sulphates of other valency-types, but in no other salts of the Mg series. It is associated with the SO_4'' ion.   F. J. G.

Reciprocal and Bravais lattice of gypsum. W. F. DE JONG and J. BOUMAN (Z. Krist., 1938, **100**, 275—276; cf. Wooster, A., 1937, I, 17).—From an X-radiogram of gypsum, obtained with a moving-film spectrometer (A., 1938, I, 234) for the zero reciprocal lattice plane with reference to the b axis, reorientation of the unit cell to give a 5·63, b 15·15, c 6·23 A., β 113° 50′, Z 4, is proposed. The relation of these results to those of Bragg, Wooster, and Onorato is indicated.   I. McA.

X-Ray analysis of the crystal structure of Na_2BeF_4. G. S. SHDANOV and N. G. SEVASTIANOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 170).—Material obtained by recrystallising a solution of BeF_2 containing excess of NaF has been examined by Laue and rotation photographs. It is orthorhombic with a 10·9, b 6·6, c 4·9 A., d_4^{20} 2·45, and there are 4 mols. per cell. The Laue symmetry agrees with the orthorhombic bipyramidal class previously suggested.   T. H. G.

Crystal structure of long-chain normal paraffin hydrocarbons. "Shape" of the methylene group. C. W. BUNN (Trans. Faraday Soc., 1939, **35**, 482—491).—X-Ray investigation indicates that normal paraffins containing chains of >130 C are orthorhombic, with a_0 7·40, b_0 4·93, and c_0 2·534 A., and space-group $Pnam$. The C—C distance is 1·53 A. and the valency angle between C·C linkings 112°. Electron-density diagrams indicate that the electron cloud is extended in the plane of the three C nuclei.   J. W. S.

Valency angles. III. Determination by means of X-rays of the binding angle at the sulphur atom in a diphenyl sulphide derivative. R. KOHLHAAS and A. LÜTTRINGHAUS (Ber., 1939, **72**, [B], 897—906).—The crystal structure of 4 : 4′-dihydroxydiphenyl sulphide decamethylene ether has been studied. The space-group is $P2_1/m$ (C_{2h}^2), with 2 mols. in the unit cell, and a 11·99, b 9·644, c 10·93 A., β 56·96°. Application of Fourier analysis gives the complete structure, except for the position of the decamethylene chain, and a diagram is given. The distance $C_{aromatic}$—S is 1·71±0·04 A., and the angle between the S valencies is 112·4±1·5°.   F. J. G.

Crystal structure of condensed ring compounds. VII. 3 : 4-Benzphenanthrene, $C_{18}H_{12}$, and three hexahydro-derivatives. J. IBALL (Z. Krist., 1938, **100**, 234—241; cf. A., 1938, I, 502).—Cell elements, ρ, Z, and optical data are determined for 3 : 4-benzphenanthrene (I), its 1 : 2 : 9 : 10 : 11 : 12-H_6-derivative (II), and for the 2-keto- and 2-keto-1 : 1-dimethyl derivatives of (II). (1) is rhombic, the others are triclinic. X-Ray data are inconclusive, but measurements of diamagnetic anisotropy (by

K. LONSDALE) confirm the stereochemical *cis* configuration for (II).   I. McA.

X-Ray and thermal examination of unsymmetrical mixed triglycerides.—See A., 1939, II, 240.

Crystal structure of cyanogen halides. I. Structure of cyanogen iodide. J. A. A. KETELAAR and J. W. ZWARTSENBERG (Rec. trav. chim., 1939, **58**, 448—452).—ICN has d^{18} 2·84. It forms a lattice of separate mols. and not an ionic lattice. The rhombohedral unit cell has a 4·44±0·02 A., α 101° 24′±10′; probable space-group C_{3v}^5. C. R. H.

Structure and thermal properties associated with some hydrogen bonds in crystals. I. The isotope effect. II. Thermal expansion. J. M. ROBERTSON and A. R. UBBELOHDE (Proc. Roy. Soc., 1939, **A**, **170**, 222—240, 241—251).—I. The effect of substituting D for H in CO_2H and OH groups has been investigated by measuring changes of lattice parameter. In all cases an expansion is observed, being largest for $H_2C_2O_4,2H_2O$ (I) and small for o-$C_6H_4(CO_2H)_2$ and β-resorcinol. Intermediate vals. are observed for $NaHCO_3$, succinic and benzoic acids, and α-resorcinol. A marked directional effect is found in (I) and a tentative explanation is put forward.

II. The thermal expansion of NaCl, (I), $D_2C_2O_4,2D_2O$, $C_6H_4(OH)_2$, and $C_6H_4(OD)_2$ was measured by X-ray methods in the temp. range 90—290° K. Anisotropy of expansion is observed in crystals containing OH and H bonds; the expansion of D crystals is < that of H crystals.   G. D. P.

Structure of oxamide. L. MISCH and A. J. A. VAN DER WYK (Arch. Sci. phys. nat., 1938, [v], **20**, Suppl., 96—98).—Larger crystals of $(CO·NH_2)_2$ than those ordinarily obtained were prepared by boiling for long periods a suspension in H_2O or $HCO·NH_2$. X-Ray examination of the crystals gives a 5·18, b 3·63, c 5·65 A., α 66° 5′, β 84°, γ 64°; one mol. in the unit cell. The atoms are arranged chiefly in a plane parallel to ac. The crystals were also examined by the method of Patterson. There is mutual attraction of NH_2 and O in the plane ac, which causes an increase in the C—C distance. This is estimated at 1·65 A. instead of the normal 1·53 A.   A. J. M.

Width of rings formed by electron-diffraction. G. P. THOMSON and M. BLACKMAN (Proc. Physical Soc., 1939, **51**, 425—431).—Mathematical.   N. M. B.

Electron asymmetry in the atoms of zinc crystals. G. E. M. JAUNCEY and E. M. McNATT (Physical Rev., 1937, [ii], **52**, 256).—The diffuse scattering of X-rays from single crystals of Zn at room temp. has been measured at various scattering and orientation angles, and used to calculate the true at. structure factors. The differences found for these vals. give a measure of the electron asymmetry.   L. S. T.

Electron-diffraction investigation of methylacetylene, dimethylacetylene, dimethyldiacetylene, methyl cyanide, diacetylene, and cyanogen. L. PAULING, H. D. SPRINGALL, and K. J. PALMER (J. Amer. Chem. Soc., 1939, **61**, 927—937).—An

electron diffraction study of gaseous CH:CMe (I), (:CMe)$_2$ (II), (·C:CMe)$_2$ (III), (·C:CH)$_2$ (IV), C_2N_2 (V), and MeCN (VI) leads to the following vals. for interat. C—C distances in A. : single bond adjacent to triple bond, 1·46±0·02 (I), 1·47±0·02 (II) and (III), 1·49±0·03 (VI); triple bond, 1·20±0·03 (I), 1·20±0·02 (III), 1·19±0·03 (IV); single bond between two conjugated triple bonds, 1·38±0·03 (III), 1·36±0·03 (IV), 1·37±0·02 (V); C≡N, 1·16±0·02 (V), 1·16±0·03 (VI). The decrease below the normal val. of 1·54 A. for a single bond adjacent to a triple bond found for the methylacetylenes and MeCN is due partly to a change in single-bond radii (by ∼0·02 A.) but chiefly to the assumption of partial double-bond character by the single bond. The vals. found for a single bond between two conjugated triple bonds indicate that this bond has ∼40% double bond character, the amount of conjugation being ∼ twice that for systems involving double bonds and benzene rings.   W. R. A.

Electron diffraction investigations of trimethylamine oxide and dimethyl sulphone and their bearing on the lengths of co-ordinate links. M. W. LISTER and L. E. SUTTON (Trans. Faraday Soc., 1939, 35, 495—505).—Electron diffraction measurements indicate that in NMe_3O the C—N bond length is 1·54±0·03 A., 0·07 A. > the sum of the normal covalent radii, and the N—O length is 1·36±0·03 A., exactly the sum of the normal single-bond radii. The N atom appears to have a greater radius when 4-covalent than when 3-covalent, the shortening of the NO bond being probably due to the effective charges at its two ends. The lengths of the C—S bonds in Me_2SO_2 are 1·90±0·03 A., 0·09 A. > in Me_2S, and the S—O bond lengths are 1·44±0·03 A. It is considered that the latter are double bonds, and that the extra contraction is connected with their stability.   J. W. S.

Diffraction of electrons by anthracene. A. CHARLESBY, G. I. FINCH, and H. WILMAN (Proc. Physical Soc., 1939, 51, 479—528).—Diffraction gives results in agreement with structure as determined by X-rays. In addition to the normal characteristic multispot pattern, another pattern consisting of areas or islands of diffuse scattering appear superimposed, and this pattern is shown to be due to mols. which, although oriented with respect to the beam, have no definite phase relationship with each other. The diffuse area pattern is thus virtually equiv. to that which would be given by a gaseous stream of oriented mols. flowing past the electron beam. Methods for determining the crystal orientation from a consideration of the normal electron-diffraction pattern features are developed, and it is shown that the diffuse area pattern is due to mols. which, although in or near their normal positions and orientations, are acting as independent scattering groups. An extension of the Debye theory to mol. lattices shows that the new patterns can be explained on the supposition that the mols. vibrate thermally, as almost rigid units, about their mean positions in the lattice.   N. M. B.

New method of creating electrification. (SIR) A. FLEMING (Proc. Physical Soc., 1939, 51, 402—406).—If pure dry SiO_2 powder of uniform grain size falls on a perforated metal plate or gauze of Zn, Cu, Ni, or Fe so as to fall through the apertures and not accumulate on the metal, the powder becomes electrified negatively and the metal positively, although bulk SiO_2 is easily electrified positively. The effect is also shown by powdered S. There is evidence that the effects are not due to piezo-electrification.   N. M. B.

Dynamic measurement of the elastic, electric, and piezoelectric constants of Rochelle salt. W. P. MASON (Physical Rev., 1939, [ii], 55, 775—789).—The consts. were determined at low field strengths by measuring the resonant frequencies and impedance of vibrating crystals. The resonant and antiresonant frequencies are found experimentally to be considerably below the natural mechanical resonant frequency of the crystal, in disagreement with the usual derivation of the frequencies of a piezoelectric crystal. Assuming that the piezoelectric stress ∝ the charge density on the electrodes rather than ∝ the potential gradient as usually assumed, theoretical frequencies in agreement with experiment are obtained. This derivation and the measured frequencies supply vals. for the piezoelectric consts. The elastic consts. measured dynamically show some differences from those measured statically; in the case of piezoelectric consts. the differences are large, and this may be attributed to the finite relaxation time for the piezoelectric elements.   N. M. B.

Electrical conductivity, light transmission, and structure of thin gold films. D. A. WAS (Physica, 1939, 6, 382—389).—The crystallisation of Au films deposited by evaporation on to glass or quartz plates is accompanied by an increase in electrical conductivity and light transmission. The crit. thickness below which crystallisation does not occur is ∼5 mμ. on clean outgassed glass or quartz, and less on quartz or on glass which has not been outgassed.   L. J. J.

Relation of the true structure of thin gold films to the structure as shown by electron diffraction. D. A. WAS (Physica, 1939, 6, 390—392).—Electron diffraction shows cryst. structure in Au films of all thicknesses from <2 mμ. upwards. Electrical conductivity measurements (cf. preceding abstract) show that this is due to crystallisation induced by the impact of electrons.   L. J. J.

Very thin sheets of platinum. P. ROUARD (Compt. rend., 1939, 208, 1146—1148).—Extending previous work (cf. A., 1937, I, 228; 1938, I, 303), the phase change of light (λ = 3660, 4046, 4358, 5461, and 5780 A.) observed on reflexion from thin Pt sheets (1·6—17·9 mμ. thick) deposited on plane glass plates by cathodic sputtering has been determined. The data are compared with theoretical predictions.   W. R. A.

Influence of dissolution by an acid of the surface of bismuth and zinc crystals on their mechanical properties. M. CLASSEN-NEKLUDOVA (Tech. Phys. U.S.S.R., 1938, 5, 827—835).—Removal of the surface defects of single crystals of Bi by dissolution in acids during the process of deformation

causes an increase in their mechanical strength up to 270%. There was also an increase in the degree of plastic elongation. Preliminary dissolution and subsequent extension in air does not cause any appreciable change in the mechanical properties of single crystals of Bi, indicating that primary defects do not of themselves exert any considerable effect on the strength. No definite results were obtained when similar experiments were carried out with single crystals of Zn. Artificial scratches appear to have no effect on the place at which fracture of single crystals of Zn occurs, even at $-180°$.　　　　　　　　　　A. J. M.

Influence of temperature on the elasticity and on the rupture of crystals. J. EKSTEIN (Compt. rend., 1939, **208**, 1098—1100).—Mathematical.
　　　　　　　　　　　　　　　　W. R. A.

Plastic deformation of rock-salt under constant compressive forces. M. STAMATIU (Bull. Acad. Sci. Roumaine, 1938, **20**, 24—30).—The effect of time on the deformation of rock-salt subjected to const. compressive forces is represented graphically. Under such forces rock-salt undergoes elastic and plastic deformations, the latter increasing with time. The results are discussed in relation to the behaviour of rock-salt in mines.　　　　　　L. S. T.

Non-cubic growth of single crystals of silver by condensation from vapour. J. H. HOWEY (Physical Rev., 1939, [ii], **55**, 578—581).—The condensation of Ag vapour on solidified spherical drops of Ag produces straight thin single-crystal needles of Ag under certain conditions, and is a process continuous with the formation of the drops by condensing the vapour in vac. on an Fe surface cooling from above the m.p. of Ag to an equilibrium temp. just below the m.p. The shape and cryst. orientation of the needles indicate that they are the result of a nucleus growing by condensation much more rapidly in a certain (110) direction than in other directions, including other (110) directions.　　　　　　　N. M. B.

Stabilisation velocity of glassy selenium. F. ISHIKAWA and H. SATO (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 143—149).—The stabilisation velocity of glassy Se, measured by a differential gas dilatometer, is very low at 60° and increases with temp., 60% transformation into metallic Se occurring in 33 hr. at 75°.　　　　　　　　F. H.

Polymorphism of lead [mon]oxide. J. LE´ BOURGEOIS (Bull. Soc. chim., 1939, [v], **6**, 614—620). —There are three modifications, one pink (γ) and two yellow (β and α). γ is stable up to 150°, but transformation into β does not occur below ~570°, whilst β is stable from 150° to 700—800°, but can be metastable at room temp. and up to its m.p., 886°. α is formed slowly from β at 800° and rapidly at the m.p. of β. Its m.p. is 894°, and on cooling it is not transformed into β but persists in a metastable state down to 250°, when it is transformed into γ.　　F. J. G.

Growth on alkali halide crystals. H. MORGENSTERN (Z. Krist., 1938, **100**, 221—227; cf. Ernst, A., 1937, I, 447).—The development of the surface morphology of single-crystal spheres of LiF, NaCl, KCl, KBr, and KI immersed in aq. solution at 29°,

and prepared by grinding crystals obtained from the melt by Kyropoulos' method, is described.　I. McA.

Regular growth of *pp'*-dihydroxydiphenyl on calcite and on sodium nitrate. J. WILLEMS (Z. Krist., 1938, **100**, 272—274; cf. Royer, A., 1933, 213).—Given favourable geometric lattice conditions, regular overgrowth of org. crystallites on an inorg. support still requires an ionisable solute. $(C_6H_4\cdot OH)_2$ ppts. almost amorphously from oxy-solvents on glass; on calcite or $NaNO_3$ it deposits in crystallites of elliptical cross-section, singly or in crossed pairs, showing characteristic epitaxy.　　　　　　　I. McA.

Peltier effect demonstration with approximate measurement. A. CAMPBELL (Proc. Physical Soc., 1939, **51**, 545—546).—Three strips of two metals are soldered consecutively and bent into a U so that the junctions are adjacent in the two legs of the U. On passing a current the heating of one junction and cooling of the other is shown by a thermopile placed between the junctions. Approx. measurement is made by balancing the cooling at one junction against the heating effect of a current in a small adjacent resistance coil.　　　　　　　　　　N. M. B.

Magnetism and chemistry. W. KLEMM (Chem.-Ztg., 1939, **63**, 333—335).—A review.

Reversible magnetisation in ferromagnetics. W. F. BROWN, jun. (Physical Rev., 1939, [ii], **55**, 568—578).—Mathematical. The equations of the statistical domain theory are derived without the use of the artificial simplified Heisenberg model.
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Magnetic susceptibility of mercury and of some dilute alkali amalgams. S. R. RAO and S. ARAVAMUTHACHARI (Proc. Indian Acad. Sci., 1939, A, **9**, 181—209).—For liquid Hg $\chi_{at.} = -33\cdot3 \times 10^{-6}$, suggesting that the Hg atoms exist in the liquid state as Hg$\cdot\cdot$ ions. χ for Na, K, and Rb, and their dil. amalgams have been measured. For very low concns. addition of Li causes an increase in χ_{Hg} whilst addition of Na, K, and Rb decreases it. The initial fall of χ is probably due to dispersion of alkali atoms, each atom being surrounded by a group of Hg atoms forming a " complex " atom of lower χ. To explain the initial rise for Li amalgams it is assumed that the Li atoms are unable to penetrate the Hg groups, until a higher concn. is reached. A broad min. occurs in χ of Na amalgams at a concn. approx. corresponding with the compound $NaHg_{16}$.　　W. R. A.

Specific coefficient of magnetisation of oxyhæmoglobin.—See A., 1939, III, 622.

Magnetic susceptibility and related properties of rare-earth crystals. W. G. PENNEY and G. J. KYNCH (Proc. Roy. Soc., 1939, A, **170**, 112—129).— A theoretical investigation shows that it is impossible to reconcile current interpretations of the absorption spectra and sp. heat measurements with the magnetic properties of hydrated rare-earth crystals.　G. D. P.

Principal magnetic susceptibilities of neodymium sulphate octahydrate at low temperatures. L. C. JACKSON (Proc. Roy. Soc., 1939, A, **170**, 266—271).—The measurements were carried out in the temp. range 14—290° K. All three suscep-

tibilities obey the law $\chi(T + \Delta) = $ const. above 120° K.; at low temp. one of the principal susceptibilities tends to become independent of T, whilst the other two increase more rapidly than they do at higher temp. The magnetic ellipsoid rotates through a considerable angle as the temp. falls, the anisotropy increasing from 11% to 70% between 290 and 14° K. (Cf. preceding abstract.) G. D. P.

Influence of elastic stresses on the initial susceptibility of monocrystals. M. DECHTJAR (Tech. Phys. U.S.S.R., 1938, **5**, 676—684).—Experiments on monocrystals (thin narrow laminæ) of meteorite Fe, containing 8% Ni and 0·5% Co, show that (i) Akulov's tensor of magnetic susceptibility χ of deformed cubic crystals is correct, (ii) the changes in the magnitude of the initial χ caused by the influence of elastic stresses depend on the sequence of application of these stresses and the strength of the magnetic field, and (iii) the demagnetisation of a ferromagnetic substance under load does not follow the usual course. W. R. A.

Electronic theory of the electrical equilibrium of metallic conductors. D. CASTELLUCCIO (Nuovo Cim., 1938, **15**, 473—476).—Mathematical. O. J. W.

Tantalum. (A) Resistance, emissivities, and m.p. (B) Rate of evaporation. L. MALTER and D. B. LANGMUIR (Physical Rev., 1939, [ii], **55**, 743—747, 748—749; cf. Utterback, A., 1932, 565).—(A) The relation between true and brightness temp. was determined by pyrometric observations on the inside and outside of a long thin-walled tube heated electrically. Potential leads of fine W wire welded to Ta filaments permitted a determination of the electrical properties as a function of temp. The m.p. found is 3269° K. from the electrical properties at the m.p., as given by the extrapolated temp.–electrical property relations.

(B) The rate of evaporation at const. temp., determined by measuring the change of resistance and change of wt. of uniform filaments, is given by $\log_{10} M = 7·86 - 39{,}310/T$, where M is the rate of evaporation in g. per sq. cm. per sec. N. M. B.

Electrical phenomenon of a palladium filament occluding hydrogen. K. HIROTA and J. HORIUTI (Proc. Imp. Acad. Tokyo, 1939, **15**, 10—12). —A Pd wire of 8 μ. diameter and 1·0 cm. length had initial resistance of 13·18 Ω. On continuous evacuation of H_2 for 864 hr. a min. resistance of 11·35 Ω. was obtained, which then increased to the const. val. 25·77 Ω. The cycle was repeated by the stepwise admission of H_2. F. J. L.

Variation of the specific resistance of platinum with cross-section. L. RIEDEL (Ann. Physik, 1938, [v], **33**, 733—736).—Measurements on Pt wire of 15·7 μ. diameter show that the sp. resistance at 0° is > that of the compact metal by <1%, in contradiction to Reuter (A., 1938, I, 19). The mean free path of the conduction electrons is <100 mμ. O. D. S.

Electrical resistance of nickel amalgams. L. F. BATES and J. H. PRENTICE (Proc. Physical Soc., 1939, **51**, 419—424; cf. A., 1938, I, 70).—The resistances of a series of Ni amalgams of concn. 0·013—0·246 g. Ni per 100 g. Hg, measured over the range 20—300°, showed a marked permanent change beginning at ∼225° coinciding with a change from diamagnetic to strong and permanent ferromagnetic properties. Since ferromagnetic Fe or Co in amalgams can be conc. and removed by a magnetic field, a method of determining Co in mixed solutions of Co and Ni salts is suggested. N. M. B.

Electrical resistance and thermo-e.m.f. of the two allotropic modifications of thallium. E. ROSENBOHM (Physica, 1939, **6**, 337—352).—For pure Tl in an atm. of H_2 the allotropic transition at 232° is marked by an abrupt fall of 4·3% in the resistance. The effect is less marked, and the transition is displaced to lower temp., in the presence even of small amounts of O_2 and N_2. Hysteresis effects are in all cases small, but are more marked with slightly oxidised Tl. The transition coincides with a flat max. in the temp. coeff. of the thermo-e.m.f. (measured against Cu). L. J. J.

Supersonic dispersion in air. W. H. PIELEMEIER (Physical Rev., 1937, [ii], **52**, 244). L. S. T.

Fresnel diffraction phenomena at ultrasonic waves and their evaluation by Mascart's method. F. MAHLER (Ann. Physik, 1939, [v], **34**, 689—716).— The Fresnel diffraction of light waves (λ 0·646 to 0·480 μ.) by standing ultrasonic waves (λ^x 0·5 to 0·58 mm.) has been investigated. Results agree with theory derived by Mascart's approximation method. O. D. S.

Dispersion of ultrasonic waves in liquids. F. MATOSSI (Physikal. Z., 1939, **40**, 294—297).—The discrepancies between the results of Hiedemann et al. (A., 1936, 1453) and of Dutta (A., 1938, I, 184) have been investigated. The results of Dutta were reproduced at 27°. At room temp., however, there was an increase in the ratio of the velocity of ultrasonic waves in H_2O and PhMe with increasing frequency. Under certain conditions dispersion effects could be reproduced even at room temp. depending on the coupling of the vibrating quartz with the transmitter. The more intense was the sound wave, the greater was the dispersion effect. With very slight coupling the effect disappeared. It is concluded that no dispersion effect can be found in the frequency region 10^7 Hz. for H_2O or xylene. A. J. M.

Effect of ultra-sounds on supercooled water. I. SOKOLOV (Tech. Phys. U.S.S.R., 1938, **5**, 619—621).—Water supercooled to —6°, which remained liquid after vigorous shaking, crystallised when subjected to ultra-sounds, the velocity of crystallisation increasing with the energy supplied, but being apparently independent of the frequency. J. A. K.

Supersonic velocity in gases and vapours. VIII. Supersonic velocity in air, steam, carbon dioxide, and carbon disulphide. S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 93—110).—The velocity of sound v in air, steam, CO_2, and CS_2 has been measured at different frequencies in narrow tubes at different temp. and 685 mm. pressure. The sp. heats, calc. from v, are in good agreement with those calc. from spectroscopic data. W. R. A.

Thermal measurements in liquid hydrogen. H. GUTSCHE (Z. physikal. Chem., 1939, **184**, 45—58). —C_p data for liquid H_2 between 20° and 40° K. and between 10 and 100 atm., and data for the heat change during the expansion of liquid H_2 over the same range of pressure and for the sp. heat under the saturation pressure, are recorded and discussed. C. R. H.

Specific heat, enthalpy, entropy, and dissociation of technical gases. E. JUSTI (Feuerungstech., 1938, **26**, 313—322).—Sp. heats calc. for ideal gases from spectroscopic data are converted by means of various equations of state to the actual condition at a pressure of 1 atm. The difference between the mean and true sp. heats for ideal and practical conditions (1 atm.) are tabulated from 0° to 1000° for N_2, H_2, O_2, NO, CO, CO_2, N_2O, SO_2, H_2O, air, CH_4, C_2H_2, C_2H_4, C_2H_6, and C_6H_6. R. B. C.

Specific heat of iron from 1·1° to 20·4° K. W. H. KEESOM and B. KURRELMEYER (Physica, 1939, **6**, 364).—For a sample of very pure Fe, $C = 0.00120T + 0.00000472T^3$ g.-cal. per mol. per degree, corresponding with a characteristic temp. 462° K. L. J. J.

Liquid structure and entropy of vaporisation. J. H. HILDEBRAND (J. Chem. Physics, 1939, **7**, 233—235).—Comparison of the entropies of vaporisation of 24 liquids at temp. corresponding with the same vapour vol. indicates that the factors tending to produce an ordered arrangement in a liquid are (a) chemical association, (b) dipole orientation, and (c) geometrical shape. The significance of (c) is discussed in connexion with the entropy of solution. W. R. A.

Atomic heat of nitrogen in various nitrides. II. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 385—398; cf. A., 1938, I, 507).— The at. heats of N in Mg, Ti, P, Be, Mn, Th, Zn, and Li nitrides at 25°, 100°, 300°, and 500° have been calc. from measurements of the mol. heats of the nitrides, and the at. heats of the elements concerned. The at. heat of N is low in nitrides of elements of small at. no. Including previously determined vals. from nitrides of B, Al, Si, Ca, V, Mo, and Ta, the mean at. heat of N in nitrides is 3·1, 3·7, 5·1, and 6·1 at 25°, 100°, 300°, and 500°, respectively. D. F. R.

Specific heats of thorium nitride, lithium nitride, and zinc nitride. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 182—190). —The mean C_p of Th_3N_4 and Li_3N has been measured over the temp. intervals 0—99·5°, 0—305·3°, and 0—500·3° by the ice calorimeter. The true C_p of Th_3N_4 is given by $C_p = 0.04895 + 4.436 \times 10^{-5}0 - 1.384 \times 10^{-8}0^2$ and of Li_3N by $C_p = 0.5127 + 7.226 \times 10^{-4}0 - 1.193 \times 10^{-7}0^2$. The mean C_p of Zn_3N_2 has been measured over the temp. intervals 0—99·6°, 0—305·3°, and 0—419·2°, true C_p being given by $C_p = 0.1142 + 8.926 \times 10^{-5}0 + 1.151 \times 10^{-8}0^2$. F. H.

M.p. of barium molybdate. H. A. LIEBHAFSKY. E. G. ROCHOW, and A. F. WINSLOW (J. Amer. Chem. Soc., 1939, **61**, 969—970).—Ba molybdate (I), pptd. from an aq. NH_3 solution of NH_4 molybdate by $BaCl_2$, was melted in a Pt crucible in air and slowly cooled.

The m.p. is 1480±5°. Pt was not attacked and there was no indication of decomp. of (I). On melting in vac. the surface of (I) darkens, some evaporation occurs, partial decomp. occurs, and the m.p. is approx. the same as in air. W. R. A.

Melting as a disorder phenomenon. F. C. FRANK (Proc. Roy. Soc., 1939, **A, 170**, 182—189).— The Bragg and Williams theory of order-disorder transformations is applied to melting. There are crit. temp. above and below the m.p. which limit the range of existence of the metastable, superheated and supercooled, states. The m.p. lies close to the upper crit. point so that it is impossible to superheat a crystal but a considerable degree of supercooling may be necessary to start crystallisation in a liquid. The paper is non-mathematical. (Cf. A., 1939, I, 248.) G. D. P.

Adiabatic demagnetisation of potassium chromic alum. H. B. G. CASIMIR, W. J. DE HAAS, and D. DE KLERK (Physica, 1939, **6**, 365—368).—The entropy of K Cr alum as a function of the magnetic temp. (T_m) from 1° to 0·033° K. has been determined. The results are in agreement with Hebb and Purcell's theory (A., 1937, I, 353) for all temp. between 0·07° and 1° K.; in this range the relation between T_m and T is given with an accuracy of 0·01° K. The Stark splitting is 0·27° K. L. J. J.

Liquid versus vapour temperature. E. M. LITTLE (Physical Rev., 1937, [ii], **52**, 255—256).— When temp. is defined as $\propto$ the average kinetic energy of translation of the mols. the temp. of a liquid and vapour in equilibrium are not the same. The vapour temp. may be $\frac{2}{3}$ the liquid temp. Spectroscopic and not thermometric methods must be used to detect this temp. difference. L. S. T.

Reference temperatures for physical and physico-chemical magnitudes of [chemical] compounds. G. L. VOERMAN (Congr. int. Quim. pura apl., 1934, **9**, II, 483—484; Chem. Zentr., 1937, i, 1104).—The use of the c. scale and of 20° as a standard temp. is recommended, and other reference temp. are proposed. A. J. E. W.

Formation of an amorphous (vitreous) modification of water by condensation of vapour at low temperature. L. STARONKA (Rocz. Chem., 1939, **19**, 201—212).—A transparent coating forms in a glass tube at $< -175°$ (liquid N) through which a slow current of damp air is passed. The deposit becomes opaque at about $-130°$, and this change is associated with evolution of $\lessgtr 5.7$ g.-cal. per g. of the ice. The internal energy of the condensate formed at $< -170°$ is about 100 g.-cal. per g. higher than that of the condensate formed at $> -170°$. The new product is considered to be a vitreous modification of H_2O. R. T.

Symmetry number and thermodynamic functions for molecules having double minimum vibrations. K. S. PITZER (J. Chem. Physics, 1939, **7**, 251—255).—Energy levels and thermodynamic functions for a double min. vibrational degree of freedom are discussed with special reference to NH_3. A simple formula is given for the range of validity of the classical expressions for rotational heat capacity

and entropy and the symmetry no. of double min. vibrators is considered.   W. R. A.

Equations of state. G. WOOLSEY (J. Chem. Educ., 1939, **16**, 60—66).—A discussion.   L. S. T.

Differences in vapour pressures and molecular heats of ortho- and para-hydrogen and deuterium. K. SCHÄFER (Z. physikal. Chem., 1939, **42**, B, 380—394).—Mathematical. Energy proper vals. of H_2 in the condensed state have been estimated using quantum-mechanical perturbation theory; different vals. are obtained for the perturbation of o- and p-H_2.   W. R. A.

Saturation pressure of water vapour between 73° and 130°. H. MOSER and A. ZMACZYNSKI (Physikal. Z., 1939, **40**, 221—229).—A static method (using a glass-membrane manometer) and a dynamic method have been used to determine the saturation pressure of H_2O vapour in the above temp. range. The following formulæ were obtained : $p - 760 = 27 \cdot 12912(\theta - 100) + 0 \cdot 400793(\theta - 100)^2 + 3 \cdot 04131 \times 10^{-3}(\theta - 100)^3 + 1 \cdot 1241 \times 10^{-5}(\theta - 100)^4$, for θ between 73° and 130°, and $\theta - 100 = 3 \cdot 68608 \times 10^{-2}(p - 760) - 2 \cdot 0073 \times 10^{-5}(p - 760)^2 + 1 \cdot 625 \times 10^{-8}(p - 760)^3 - 1 \cdot 61 \times 10^{-11}(p - 760)^4$, for p between 680 and 800 mm.   A. J. M.

Vapour pressure of solid salts. I. Vapour pressure of mercuric halides and thermodynamic calculations. Z. SHIBATA and K. NIWA. **II. Vapour pressure of alkali halides and thermodynamic calculations.** K. NIWA (J. Fac. Sci. Hokkaido, 1938, **2**, 183—200, 201—221).—I. V.p. of $COPh_2$ (35—55°), $HgCl_2$ (45—70°), $HgBr_2$ (50—75°), and red HgI_2 (60—90°) have been determined by Knudsen's effusion method. Heats of sublimation, free energy change, entropy, and chemical const. are calc.

II. Similar measurements have been made with all the alkali halides except LiF, LiBr, LiI, NaI, RbF, RbBr, CsF, and CsI. These data and those of other workers for the salts named are used for calculating the thermodynamical quantities.   F. L. U.

Vapour pressure of thorium acetylacetonate by radioactivity measurements. R. C. YOUNG, C. GOODMAN, and J. KOVITZ (J. Amer. Chem. Soc., 1939, **61**, 876—878).—By means of a gas-saturation method, which employs non-radioactive N_2 and counts the α-particles carried over by the N_2, the v.p. of Th acetylacetonate (I) at 1000° is $3 \cdot 2 \pm 0 \cdot 3 \times 10^{-4}$ mm. The amount of sublimed (I) was calc. by washing out the apparatus with EtOH acidified with HCl, evaporating the solution on a Pt foil, and counting the no. of α-particles from the deposit of basic Th chloride. An improved prep. of (I) is given.   W. R. A.

Critical constants of ethane. J. A. BEATTIE, G. J. SU, and G. L. SIMARD (J. Amer. Chem. Soc., 1939, **61**, 924—925).—The v.p. of C_2H_6 at 25° is 41·38 atm. The crit. consts. are $t_c = 32 \cdot 27° \pm 0 \cdot 01°$, $p_c = 48 \cdot 20 \pm 0 \cdot 02$ normal atm., $v_c = 0 \cdot 148 \pm 0 \cdot 0015$ l. per mol. (4·93 c.c. per g.), $d_c = 6 \cdot 76 \pm 0 \cdot 07$ mols. per l. (0·203 g. per c.c.).   W. R. A.

Specific gravity change per degree of temperature.—See A., 1939, II, 237.

Density of pure deuterium oxide. H. L. JOHNSTON (J. Amer. Chem. Soc., 1939, **61**, 878—880).—After correcting for the presence of ^{18}O and other factors which are discussed, d_{25}^{25} of D_2O is $1 \cdot 10763 \pm 0 \cdot 00005$.   W. R. A.

Thermal and electrical conductivity of iron at high temperatures. R. W. POWELL (Proc. Physical Soc., 1939, **51**, 407—418).—Results previously reported (cf. A., 1934, 1163) are confirmed by two independent methods. The thermal conductivity of Armco Fe, determined to ~1000° by an abs. method in which heat flowed radially from the centre to the circumference of a thick-walled cylinder, decreases steadily with rise of temp. through the magnetic transformation region to a min. val. of 0·065 near the α–γ transformation point. Electrical resistivity was measured up to 1430°, and the Lorenz function evaluated over the experimental thermal conductivity range; from 200° to 800° it has unusually high vals. $(0 \cdot 72 \pm 0 \cdot 02 \times 10^{-8})$, but decreases steadily above the magnetic transformation point to $0 \cdot 60 \times 10^{-8}$ at 1000°. The Lorenz function of γ-Fe is thus in fair agreement with the val. $0 \cdot 58_6 \times 10^{-8}$ indicated by Sommerfeld's theory.   N. M. B.

Amorphous state. XIV. Thermal conductivity of amorphous bodies within the range of softening. E. KUVSCHINSKI (Tech. Phys. U.S.S.R., 1938, **5**, 491—498).—Data for rosin (I) and phenolphthalein (II) afford no evidence for the presence of a break in the thermal conductivity (k) curve within the range of softening. $k = 0 \cdot 00024$ g.-cal./degree. cm. sec. for (I) over the range 20—90°, and $k = 0 \cdot 000335$ g.-cal./degree. cm. sec. for (II) over the range 35—115°.   C. R. H.

Compressibility of gaseous ethane in the high density region. J. A. BEATTIE, G. J. SU, and G. L. SIMARD (J. Amer. Chem. Soc., 1939, **61**, 926—927).—Vals. for the compressibility of gaseous C_2H_6 at densities from 5—10 mols. per l. have been determined at 25° intervals between 50° and 275°.   W. R. A.

Kinetic theory expression for the viscosity of a gas. K. S. G. DOSS (Current Sci., 1939, **8**, 109).—The η of a gas can be expressed by $\pi^{-1}(MRT/\pi)^{\frac{1}{2}}N^{-1}d^{-2}$, where d is the diameter of the mol.; it is practically the same as the accurate expression derived by Chapman (A., 1916, ii, 416).   L. S. T.

Calculation of surface viscosity from experimental results. J. J. HERMANS (Physica, 1939, **6**, 313—320).—Harkins and Kirkwood's formula (A., 1938, I, 186) for a rectangular slit also applies to a canal formed by mica plates resting on the surface, as in Joly's experiments (ibid., 77).   L. J. J.

Influence of electric field on the viscosity of liquids. H. MENZ (Ann. Physik, 1939, [v], **34**, 740—760).—A capillary viscosimeter for the comparison of viscosities in high electric fields (20 kv. per cm.) is described. The effect of static and alternating field, up to 600 Hz., on the viscosity of C_6H_6, Et_2O, PhCl, and CCl_4 has been investigated. In the pure liquids the effect is very small but on saturation of Et_2O and PhCl with H_2O an increase of viscosity with field is observed with characteristic polarisation

effect and dependence on frequency. This increase is ascribed to the transference of velocity by ions moving at right angles to the direction of flow.

O. D. S.

Amorphous state. XIII. Viscosity, electrical conductivity, and dielectric losses in alcohols and glycerol. P. KOBEKO, E. KUVSCHINSKI, and N. SCHISCHKIN (Tech. Phys. U.S.S.R., 1938, 5, 413—424).—The variation of η, sp. resistance r, ϵ, and dielectric loss ϵ' with temp. have been studied for $Pr^\alpha OH$, $Bu^\beta OH$, and glycerol over wide temp. ranges. Measurements of η have been made over a range of 10^{-2}—10^{10} poises, and of ϵ and ϵ' at 50 and 1000 Hz. Relaxation times τ have also been evaluated. It is found that $\log \eta$, $\log r$, and $\log \tau$ are not rectilinear functions of $1/T$ but that the temp. coeffs. which are equal at the same temp. rise with fall of temp. η, r, and τ are proportional to each other when temp. varies.

T. H. G.

Dependence of viscosity of long-chain fatty acids on temperature and degree of unsaturation. G. B. RAVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 34—36).—For C_{18} acids the viscosity decreases linearly with increasing I val. A general equation for the effect of temp. is given, and data in agreement for a no. of C_{18} acids are recorded.

L. J. J.

Thermal diffusion of water vapour–hydrogen mixtures. Z. SHIBATA and H. KITAGAWA (J. Fac. Sci. Hokkaido, 1938, 2, 223—239).—The changes in composition of H_2O vapour–H_2 mixtures due to thermal diffusion in a temp. gradient have been determined between room temp. (cold) and each of 10 different temp. from 201° to 1021° (hot). The relation $\log (p_A/p_B)_{hot} = n \log (p_A/p_B)_{cold} + const.$ is valid over the whole range ($p =$ partial pressure). n is a const. depending on temp. but not on composition. The results are used to calculate some quantities occurring in Chapman's theory (cf. A., 1924, ii, 823).

F. L. N.

Parachors of binary mixtures. F. ISHIKAWA and T. ATODA (Bull. Inst. Phys. Chem. Res. Japan, 1939, 18, 150—161).—[P] for the systems C_6H_6–EtOH (I), PCl_3–C_6H_6 (II), and $POCl_3$–C_6H_6, measured at 25°, agree with those calc. from vals. for solute and solvent by $[P] = (1 - x)[P]_1 + x[P]_2$ where x is the mol. fraction of solute. The max. deviation from the calc. val. is -1 obtained with (I). [P] for (I) and (II) is expressed more accurately by $[P] = a + bx$.

F. H.

Total and partial pressures of binary solutions of the butyl alcohols in benzene at 25°. B. B. ALLEN and S. P. LINGO [with W. A. FELSING] (J. Physical Chem., 1939, 43, 425—430).—Data are presented in tabular and graphical form. Departures from Raoult's law follow the order $Bu^\alpha OH < Bu^\beta OH < CHMeEt \cdot OH < Bu^\gamma OH$. This transition is attributed to increase of polarity as the H atoms of the carbinol C atom are replaced by Me.

J. W. S.

Density and refractive index of aqueous furfuraldehyde solutions. S. MOLIŃSKI, F. NOWOTNY, and W. CAŁUS (Przemyśl Chem., 1939, 23, 30—32).—d and n are recorded for the system furfuraldehyde (I)

$-H_2O$, at 20°. Pure (I) has b.p. 161·75°, d 1·1614, and n 1·52624.

R. T.

Specific heat, density, and vapour pressure in the system methyl alcohol–water–lithium chloride. E. L. TSCHERNIAK (J. Gen. Chem. Russ., 1938, 8, 1341—1352).—Sp. heat– (25° and 50°), ρ–, and v.p.–composition curves are given for the system MeOH–H_2O–LiCl ([LiCl] = 1 g.-mol. per l. of solvent).

R. T.

Viscosity in binary liquid systems. L. H. BIRD and E. F. DALY (Trans. Faraday Soc., 1939, 35, 588—592).—ρ–, η–, and mol. polarisation–composition curves have been determined for binary mixtures containing highly purified cis- and trans-decalin and tetralin, and in a few cases C_6H_6, $C_{10}H_8$, and CCl_4. A semi-empirical formula is derived from Macleod's viscosity equation, using vol. fractions instead of mol. fractions. The formula breaks down for mixtures containing tetralin, and an explanation of this is offered. η is not necessarily a function of ρ or " free space" alone. Consts. for the purified liquids are : cis-decalin, ρ_4^{35} 0·8834±0·0001, n_D^{20} 1·4806±0·0002, b.p. 195·6±0·2°/762 mm.; trans-decalin, ρ_4^{35} 0·8598±0·0001, n_D^{20} 1·4704±0·0002, b.p. 187·95±0·2°/766·5 mm.; tetralin, ρ_4^{35} 0·9573±0·0001, n_D^{20} 1·5425±0·0002, b.p. 206·8±0·2°/759 mm.

F. L. U.

Viscosity determinations of slag systems. J. R. RAIT, Q. C. M'MILLAN, and R. HAY (J. Roy. Tech. Coll., 1939, 4, 449—466).—The systems CaO–SiO_2, MnO–SiO_2, and CaO–Al_2O_3–SiO_2 have been studied. The first of these shows a min. in the η–composition isothermals at the compound CaO,SiO_2. The variation of η with composition in the other systems is not a continuous function.

T. H. G.

Pressure–temperature phase diagram of Na–K alloys and the effect of pressure on the resistance of the liquid phase. C. H. KEAN (Physical Rev., 1939, [ii], 55, 750—754).—The phase diagram of the binary system Na–K as a function of pressure, temp., and composition is plotted from determinations, at 0—150° and up to 10,000 kg. per sq. cm., of the pressures at which discontinuities occur in resistance isotherms of Na–K mixtures in various proportions. The composition of the eutectic in the subsystem solid Na–solid Na_2K–liquid is almost independent of pressure over the range, but that of the eutectic solid K–solid Na_2K–liquid moves from ~67 at.-% K at atm. pressure to 59% at 10,000 kg. per sq. cm. The rise of m.p. with pressure is markedly less for the alloys than for the pure metals; the rise of m.p. produced by 10,000 kg. per sq. cm. for the first eutectic is 42° (68° for pure Na); the corresponding rise for the second eutectic is 42° (105° for pure K). Some data for the relative resistance of the liquid alloys as a function of pressure are given.

N. M. B.

Effect of silver on the gold–copper superlattice, AuCu. R. HULTGREN and L. TARNOPOL (Amer. Inst. Min. Met. Eng., Tech. Publ., 1939, No. 1010, 10 pp.; Met. Tech., 1939, 6, No. 1).—Assuming that superlattice formation is due to attraction between unlike atoms and differences in at. size, it is shown theoretically that substitution of Ag for Au in the AuCu superlattice should lower the crit. temp. of

ordering. Experiments confirm this prediction. The orthorhombic, pseudotetragonal phase is stable over a wider temp. range than has been supposed. At lower temp. the tetragonal cell is found. The pseudotetragonal cell of the orthorhombic phase has a b/a ratio slightly >1. As the temp. of anneal falls, toward the region of stability of the tetragonal phase, the b/a ratio increases. Apparently the transformation from orthorhombic to tetragonal does not take place gradually. At room temp. the b/a ratio increases with time. The resistance of the orthorhombic phase shows that the mechanism of ordering is not as simple as has been supposed. There is a small decrease in at. vol. just above the transformation temp. At low temp. the time necessary to attain equilibrium is longer than the hitherto accepted val.
R. B. C.

Volatility of silver, in relation to the nature of the atmosphere, the temperature, and the composition of binary silver alloys. I. N. PLAKSIN and A. J. BRECHSTEDT (J. Gen. Chem. Russ., 1938, **11**, 1556—1563).—The rate of volatilisation of Ag at temp. $>1000°$ in air is $>$ in $CO_2 >$ in $N_2 >$ in coal gas; it is greater for Sb and Cu than for other alloys (with Au, Sn, or Pt). The effect is ascribed to lowering of the surface tension of molten Ag by dissolved Ag_2O or by other metals. R. T.

Influence of nickel on the solubility limits of the α-phase in copper–aluminium alloys. V. GRIDNEV and G. KURDJUMOV (Metallwirts., 1936, **15**, 229—231, 256—259; Chem. Zentr., 1937, i, 1098).—Addition of 2% of Ni to Cu–Al alloys (82—98% Cu) reduces the solubility (s) of Al in Cu and displaces the boundary of the α-phase region from 9·8 to 8·6% Al; the eutectoid line is raised from 570° to 605°. s is independent of temp. below the eutectoid decomp. temp. Increase of the Ni content to 4% causes no further shift of the α-region boundary or the eutectoid line, owing to inducement of a hardening process. The eutectoid point is displaced to higher Al contents by addition of Ni. A. J. E. W.

Reversible transformation in copper–aluminium alloys.—See B., 1939, 498.

Intermediate phases in the aluminium–copper system after slow cooling. A. J. BRADLEY, H. J. GOLDSCHMIDT, and H. LIPSON (J. Inst. Metals, 1938, **63**, Advance copy, 447—459).—The phase sequence for slowly-cooled Al–Cu alloys containing 16—30% Al has been determined by X-ray analysis; the structures of alloys with compositions between Cu_9Al_4 and $CuAl$ are all derived from a body-centred cubic lattice by the omission of varying nos. of atoms and consequent changes in symmetry. The three γ-structures are closely related and no two-phase regions exist between them; γ (Cu_9Al_4), cubic, exists between 16 and 18·8% Al, $γ_1$ ($Cu_{32}Al_{19}$) between 18·8 and 20·7% Al, and $γ_2$ (Cu_3Al_2) between 20·7 and 22·5% Al. The structures of $γ_1$ and $γ_2$ deviate slightly from cubic symmetry and the superlattices differ from each other and from γ. The ζ (Cu_4Al_3) and η ($CuAl$) phases are totally distinct and are separated from adjacent phases by definite two-phase regions; the low-temp. forms of these phases are probably monoclinic (21 atoms) and orthorhombic (20 atoms per

unit cell) respectively, and have structures related to that of Ni_2Al_3. A. R. P.

System aluminium–zinc. W. GUERTLER, H. KRAUSE and F. VOLTZ (Metallwirts., 1939, **18**, 97—100).—Alloys containing 20—50% Al have been examined microscopically and by thermal analysis. New vals. for the solidus temp. have been obtained, and it is shown that the solidus curve running from the m.p. of Al cuts the 380° eutectic horizontal at approx. 17% Al. This explains the finding by the authors and others of α crystals in alloys containing 20—30% Al. C. E. H.

***X*-Ray investigation of cobalt–aluminium alloys.** A. J. BRADLEY and G. C. SEAGER (J. Inst. Metals, 1939, **64**, Advance copy, 509—516).—The following intermetallic compounds have been detected by X-rays in the Co–Al system : CoAl, Co_2Al_5, Co_3Al_{13} or Co_2Al_9, Co_4Al_{13}, and $CoAl_3$. CoAl is body-centred cubic, a 2·8565 a., and dissolves both Co and Al with linear reduction in a. Co_2Al_5 is hexagonal, D_{6h}^4, $C6/mmc$, with 28 atoms in the unit cell, whilst the other compounds have complex structures which have not yet been resolved. Al dissolves in the cubic form of Co, but not in the hexagonal, and tends to stabilise the cubic structure on cooling; prolonged annealing at 320° of such alloys produces pptn. of CoAl and reversion of the cubic Co to the hexagonal form. A. R. P.

Variation of electrical resistance of (A) tin–zinc and (B) lead–antimony alloys at low temperature. E. KURZYNIEC (Bull. Acad. Polonaise, 1939, A, 489—497, 498—518).—(A) The ratios r of the resistances at the temp. of liquid H_2 and of liquid N_2 to the resistance at $0°$ have been measured for various Sn–Zn alloys tempered at 190°. For the lower temp. small additions of Zn to Sn cause a great increase in r. The max. val. of r is attained for ~ 2 at.-% Zn; r then decreases almost linearly with increased Zn content up to pure Zn. r varies in a similar way for the higher temp. but the max. val. is attained for 2—4 at.-% Zn.

(B) r vals. have also been obtained for Pb–Sb alloys tempered at 225°. Contrary to theoretical expectations, small additions of Pb to Sb cause a marked increase in r. It is inferred that for systems in which mixed crystals are formed small additions of one constituent must cause a marked increase in r, but that the converse is not necessarily true. The sp. conductivity isotherms have also been calc. for Pb–Sb alloys at $-252·9°$ and $-195·9°$. W. R. A.

System iron–zinc. II. F. HALLA, R. WEIL, and F. GÖTZL (Z. Metallk., 1939, **31**, 112—113; cf. A., 1938, 1, 612).—A detailed account of work already noted (A., 1939, 1, 251).

Electronic diffraction in the surface layers of metal alloys. V. KASSATOCHKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 37—38).—A comparison of electron- with X-ray-diffraction patterns shows absence of the γ-phase in surface layers of steels, and of the β-phase in those of brass, as a result of surface strains produced in polishing with emery. L. J. J.

Magnetic stability. R. GOLDSCHMIDT (Helv. Phys. Acta, 1936, **9**, 635—636; Chem. Zentr., 1937,

i, 1101).—The dependence of μ on the magnetisation and hysteresis losses in two Fe alloys is studied. Magnetic stability is shown only by a hard alloy.
<div align="right">A. J. E. W.</div>

Two series of mixed crystals between Hume-Rothery compounds in the ternary system silver–copper–zinc. K. MOELLER (Naturwiss., 1939, **27**, 167).—X-Ray and microscopic investigations show that two series of mixed crystals between Hume-Rothery compounds can exist in the Ag–Cu–Zn system. The ϵ-phases of the Ag–Zn and Cu–Zn systems (hexagonal close packing) are linked by a ternary mixed crystal series. The γ-phases of the Ag–Zn and Cu–Zn systems (space-centred cubic lattice, with 52 atoms in the cell) also form ternary mixed crystals.
<div align="right">A. J. M.</div>

Magnesium ternary systems. H. BAUR (Metallwirts., 1939, **18**, 145—149, 164—166).—Existing information on the constitution of ternary alloy systems containing Mg is reviewed.
<div align="right">C. E. H.</div>

Vapour pressure of zinc in brasses. R. HARGREAVES (J. Inst. Metals, 1939, **64**, Advance copy, 603—612).—Within the single-phase fields the v.p. of Zn in brass, Al brass, and Ni brass can be expressed in the form: $\log P = -B/T + A$, where A and B are consts. By using the vals. of Zn v.p. at suitable temp. the heats of sublimation of Zn from various brasses have been calc. by means of the reaction isochore. The effects of Zn volatilisation on the surface structure have also been examined.
<div align="right">A. R. P.</div>

X-Ray study of slowly cooled iron–copper–aluminium alloys. I. Alloys rich in iron and copper. A. J. BRADLEY and H. J. GOLDSCHMIDT (J. Inst. Metals, 1939, **65**, Advance copy, 157—169).—The equilibria in the Fe- and Cu-rich fields of the system have been determined by X-ray powder photographs of slowly-cooled alloys; in this range there are 3 phases, as well as 3 two-phase fields and 1 three-phase field. The α-phase field includes the face-centred cubic Al–Cu alloys from 0 to 20 at.-% Al and from 0 to 2·5% Fe. The β-phase field consists of 3 regions; with small amounts of Al the atoms are randomly distributed on a body-centred cubic lattice, but near FeAl$_3$ there is a superlattice in which alternate corners are occupied by Al atoms (β_1), and near 50 at.-% Al the cube centres are Fe or Cu and the corners Al (β_2). The β and β_1 fields occupy successive narrow strips along the Fe–Al edge of the system, but the β_2 field broadens into a wide area about the 50% Al line and terminates at the composition FeCu$_4$Al$_5$. In the 2- and 3-phase fields, increasing the Al content results eventually in overlapping of the 310 line of the body-centred and 400 line of the face-centred cubic patterns and finally in the coincidence of the 930 line of the γ-phase with these two lines.
<div align="right">A. R. P.</div>

Copper-rich nickel–aluminium–copper alloys. II. Constitution of the copper–nickel-rich alloys. W. O. ALEXANDER (J. Inst. Metals, 1938, **63**, Advance copy, 425—445; cf. B., 1937, 922).—The structure of Cu–Ni alloys with 1—35% Al has been examined by thermal, micrographic, and X-ray methods and the results are shown in pseudo-binary diagrams for const. Ni contents of 3, 6, 10, 20, and 40%. At high temp. the equilibria are controlled by the following facts: primary separation of NiAl containing dissolved Cu, isomorphism of Cu$_3$Al and NiAl above and their immiscibility below 750°, presence of a eutectic valley between the Ni–Al and Cu–Al binary alloys along which $\alpha + $ Ni$_3$Al first separate and then, below 1250°, $\alpha + $ NiAl. At lower temp. NiAl and Ni$_3$Al retain Cu in solid solution and extend their phase-formation influence right into the Cu corner of the ternary system to alloys containing only Ni 3, Al 3 and Ni 3, Al 1%, respectively.
<div align="right">A. R. P.</div>

Magnetic studies in the ternary system Fe–Ni–Al. J. L. SNOEK (Physica, 1939, **6**, 321—331).—Measurements of the inner demagnetisation and of the saturation vals. of alloys containing equimol. proportions of Ni and Al, both quenched from 1200° and cooled at varying rates to 500°, indicate the presence of a non-magnetic phase in all the annealed alloys from 10 to 100% NiAl. In the quenched specimens with 80—100% NiAl the basic alloy is non-magnetic. Hence, in contrast to the results of Bradley and Taylor (A., 1938, I, 74, 449) the two-phase area extends over the whole of the Fe–NiAl line, which is one of its main conodes. This is substantiated by the curve of saturation vals. against % NiAl, which is continuous in all cases, and linear in the annealed specimens. The phases are Fe$_2$ and NiAl, both body-centred, but small amounts of a face-centred phase are formed on slow cooling.
<div align="right">L. J. J.</div>

Iron–carbon–aluminium alloys.—See B., 1939, 493.

The brittle σ-phase in the ternary system iron–chromium–manganese. P. SCHAFMEISTER and R. ERGANG (Arch. Eisenhüttenw., 1938—9, **12**, 507—510; cf. B., 1937, 563).—Published data have been extended to cover all compositions in the system at 700°. Mixes were melted for 0·5 hr. at 1200°, then for 8 hr. at 800° after quenching, and finally for a long period at 700°. The isotherm is similar to those for the system Fe–Cr–Ni (A., 1939, I, 252), but owing to the greater solubility of Mn in Fe–Cr (35%) the pure σ-phase extends to 64% Mn.
<div align="right">R. C. M.</div>

Low-temperature transformation in iron–nickel–cobalt alloys.—See B., 1939, 493.

Release of air dissolved in water. A. G. SILLITTO (J. Roy. Tech. Coll., 1939, **4**, 421—426).—A graph of the solubility of " air " (2 vols. N$_2$ and 1 vol. O$_2$) at a total pressure of 760 mm. has been computed from the ordinary graph (for atm. pressure of 760 mm.). It is shown that the vol. of " air " released on warming a solution which is saturated at a lower temp. is much less than that expected from the graph. This saturation persists for many hr. It is reduced if the surface of the flask is contaminated by air. The rôle of air bubbles in promoting boiling and " singing " is noted and these phenomena are discussed.
<div align="right">T. H. G.</div>

Aqueous solubilities of unsaturated alcohols. P. M. GINNINGS, (Miss) E. HERRING, and (Miss) D. COLTRANE (J. Amer. Chem. Soc., 1939, **61**, 807—808).—The aq. solubilities (s) of 7 unsaturated alcohols at

20°, 25°, and 30° have been determined and are $>$ those of corresponding saturated alcohols. When the C:C and OH groups are close together at the centre of a compact mol. s is greatest, but diminishes with increase of mol. wt. and temp.   W. R. A.

Solubility of ethers in solutions of strong acids. G. LEJEUNE (Compt. rend., 1939, **208**, 1225—1227; cf. A., 1929, 1375).—The solubility of Et_2O in H_3PO_3 and $HClO_4$ is in approx. parallelism with the no. of doubly-linked O in the acid mol.; H_2SO_4 (assuming two such atoms) is anomalous. Cryoscopic measurements on $HClO_4$ solutions show that no definite compound is formed, and association of Et_2O and acid mols. is probably a polar effect. The increase of the Et_2O-solubility with the acid concn. does not commence until a certain crit. concn. is reached, suggesting that Et_2O mols. replace a deficiency in the H_2O associated with each acid mol. The effect of acids on the solubility is much smaller with Pr_2O, and cannot be detected with Bu_2O.   A. J. E. W.

Molecular forces and solvent power. R. G. LARSON and H. HUNT (J. Physical Chem., 1939, **43**, 417—423).—The solubilities (s) of NaCl, NaBr, NaI, KCl, KBr, and KI in $Pr^\alpha OH$, $Pr^\beta OH$, $Bu^\alpha OH$, $Bu^\beta OH$, sec.-BuOH, and n-C_5H_{11}·OH have been determined at 25°. The dielectric consts. (ϵ) of the alcohols, determined at $\sim$3000 cycles per sec., are 30·2, 24·14, 20·08, 18·55, 16·98, 17·32, 15·77, and 13·77, respectively. Plots of log s against the ϵ, $[P]$, and mol. vol. of the solvents give, with a few exceptions, smooth curves for each solute.   J. W. S.

Effect of grinding on solubility of mineral substances.—See B., 1939, 554.

Radio-cobalt as indicator for determining the solubility of Co(OH)₃. I. B. N. CACCIAPUOTI and F. FERLA (R.C. Atti Acad. Lincei, 1938, [vi], **28**, 385—388).—The solubility of $Co(OH)_3$ prepared as in ordinary analytical processes is 0·01046 mg. per l. Co was determined by measuring the activity of an added artificially radioactive isotope.   O. J. W.

Solubility of mercuric chloride in aqueous solutions of several chlorides. H. C. THOMAS (J. Amer. Chem. Soc., 1939, **61**, 920—924).—The aq. solubility of $HgCl_2$ at 25° ranges (10 determinations) from 0·27003M. to 0·2701₆M. The solubilities of $HgCl_2$ at 25° in solutions of HCl, LiCl, $CaCl_2$, $AlCl_3$, $LiCl$–$CaCl_2$, and $LiCl$–$AlCl_3$ of various concns. are recorded. In the concn. range corresponding with the solid phase $HgCl_2$ the $HgCl_2Cl'$ complex is of the same nature in all the solutions.   W. R. A.

Solubility of bone in biological fluids.—See A., 1939, III, 488.

Velocity of dissolution of aluminium in sodium hydroxide solution.—See B., 1939, 506.

Passivity of iron and steel in nitric acid solution. XXVI. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 162—170).—The extent of attack of Fe and steel in the passive state by HNO_3 increases with concn., being very rapid when $[HNO_3]$ is $>94\%$ due to the low $[H_2O]$ failing to render Fe completely passive.   F. H.

Test of Polanyi's theory of adsorption by means of adsorption measurements on glass and wood charcoal with different gases below the critical temperature. W. VAN DINGENEN (Physica, 1939, **6**, 353—363; cf. A., 1938, I, 76, 450; 1939, I, 139).—Published data for O_2, CO, H_2, and D_2 on glass and charcoal and data recorded for A, O_2, and N_2 on charcoal in the region 90—55° K. give temp.-independent adsorption potential curves in agreement with Polanyi's theory. Heats of adsorption calc. on the basis of this theory are in satisfactory agreement with vals. calc. by the Clapeyron–Clausius relation from the adsorption isotherms. CO on charcoal, however, gives different potential curves above and below 61·5° K., and the difference between H_2 and D_2 potential curves is anomalous.   L. J. J.

Densities of vapours adsorbed on charcoal. J. D. DANFORTH and T. DE VRIES (J. Amer. Chem. Soc., 1939, **61**, 873—876).—The average densities d of CCl_4 and $COMe_2$ adsorbed on a steam–CO_2-activated coconut charcoal have been determined at 30°. The large val. of d observed for small amounts of adsorbed material indicates that a small portion of the C surface possesses very large forces of attraction for the adsorbed mols. As more material is adsorbed d decreases rapidly to a min., but increases as the equilibrium pressure is increased, finally attaining the val. for the normal liquid. The data suggest that 15—20% of the surface area of the C contains active centres to which the vapour is first adsorbed. As the equilibrium pressure increases the less active centres are covered with a layer of $d < $ that of the normal liquid. Finally, further increase of pressure causes the mols. to move laterally to make room for other adsorbed mols., producing an increase in the average d.   W. R. A.

Statistical theory of the adsorption of double molecules. T. S. CHANG (Proc. Roy. Soc., 1939, A, **169**, 512—531).—A theoretical investigation of the case when a diat. mol. is adsorbed without dissociation, so that the two atoms of the mol. are accommodated on neighbouring sites. It is found that if the forces between the mols. are attractive there will be a crit. temp. at which the fraction of adsorption will exhibit a discontinuity.   G. D. P.

Surface chemistry of the platinum electrode. B. ERSHLER and A. FRUMKIN (Trans. Faraday Soc., 1939, **35**, 464—467).—Methods of investigating the adsorption of gases and ions on Pt electrodes are discussed. Ershler's method (A., 1938, I, 624) using only a very small quantity of solution minimises the depolarising action of traces of dissolved gases and permits observation of the effect of adsorbed substances on the H-charging curve. Curves are given showing the effect of traces of Na_3AsO_4 on the charging characteristic in N-Na_2SO_4, 0·02N. in H_2SO_4.   J. W. S.

Optical sensitising of silver halides by dyes. I. **Adsorption of sensitising dyes.** S. E. SHEPPARD, D. H. LAMBERT, and R. D. WALKER (J. Chem. Physics, 1939, **7**, 265—273; cf. A., 1938, I, 151, 579).—Basic cyanine dyes are completely and irreversibly adsorbed from aq. solution by AgBr, but the velocity of adsorption is greatly reduced by the presence of

gelatin. Dye mols. are held by the hydrophilic ionisable part of the mol., the hydrophobic part being in solution as a primary monolayer. A second monolayer may be formed with reversed orientation. Calculations of the adsorption-density at saturation for a primary monolayer agree with "edge-on" adsorption of the dye mols. in approx. close-packed assemblies. At least two states of aggregation must be assigned to the adsorbed dye, in agreement with the data of Leermakers *et al.* (cf. A., 1938, I, 151). They are provisionally regarded as uni- and multimol. Erythrosin and other acid dyes, which contain non-adsorbed hydrophilic groups, are incompletely and reversibly adsorbed, and appear to be oriented similarly to the cyanine dyes.   W. R. A.

Radioactive method for determining ionic adsorption at crystal surfaces. I. L. IMRE (Kolloid-Z., 1939, **87**, 12—21; cf. A., 1938, I, 25, 299).—Using Th-*B* as indicator, the true adsorption of Pb·· on PbSO₄ has been measured and found to agree with calc. vals. Addition of EtOH increases the adsorption.   F. L. U.

Adsorption in the solid phase. S. DOBIŃSKI and A. JAGIELSKI (Bull. Acad. Polonaise, 1938, **A**, 423—427; cf. A., 1939, I, 22).—The surfaces of Pb–Sb, Zn–Sn, Cu–Ca, Ag–Cd, Cu–Al–Ni (I), and Al–Cu–Ni–Mg (II) alloys have been investigated by electron-diffraction methods. Assuming that the vals. of γ for solid metals are in the same order as for molten metals, the metal of lowest γ will be adsorbed at the surface of the others. Thus Sb, Sn, Ca, Cd are adsorbed at the surface of Pb, Zn, Cu, Ag, respectively. In (I) and (II) Al and Mg respectively have the lowest γ.   W. R. A.

Comportment of the palladium–hydrogen system toward alternating electric current. G. A. MOORE (Trans. Electrochem. Soc., 1939, **75**, Preprint 22, 257—287).—The electrostatic capacity exhibited by Pd–H is attributed to the existence of the H in narrow rifts in the Pd, the whole forming a highly conc. condenser. The H within the rifts is highly ionised and itself acts as an oscillatory conductor. At a const. high H content the conductance of the system increases on passing from d.c. to a.c. of gradually increasing frequency; also the conductor exhibits a natural frequency of electrical oscillation dependent on the dimensions of the rifts. The changes in the dimensions of the rifts, and in the amount of H occluded in them, are traced under different conditions.   J. W. C.

Thickness of air-formed oxide films on iron. W. H. J. VERNON, F. WORMWELL, and T. J. NURSE (J.C.S., 1939, 621—632).—The thickness of air-formed oxide films on high-purity Fe and mild steel has been estimated from chemical analysis of films stripped from the metal by treatment in absence of air in a solution of I in anhyd. MeOH. The data, supplemented by determination of the total O in the surface by Sloman's vac. fusion method, are correlated with gravimetric determinations of the O absorbed. Data are recorded for the invisible and coloured films produced on heating the specimens in air at various temp.   J. W. S.

Influence of oxide film on aluminium on chemical and electrochemical behaviour of the metal.—See B., 1939, 505.

Spreading of oil on surface of water. BARRILLON and P. WOOG (Ann. Off. nat. Combust. liq., 1938, **13**, 223—286).—Apparatus which measures the rate and extent of film formation from a given quantity of oil on a calm or rippled H₂O surface is described. Experiments with a large no. of oils and H₂O of p_H 7·3 showed that animal and vegetable oils, particularly cod and linseed oils, give the best and mineral oils the poorest films. The order of efficiency of the oils is not the same for calm and rippled conditions. Attempts to correlate film formation with mol. wt., interfacial tension, unsaturation, and total acidity were unsuccessful.   R. B. C.

Rubbed films of barium stearate and stearic acid. L. H. GERMER and K. H. STORKS (Physical Rev., 1939, [ii], **55**, 648—654; cf. A., 1938, I, 347). —Films of Ba stearate (I) and of stearic acid (II) on polished Cr and on smooth natural faces of SiC crystals give, after rubbing with clean lens paper, electron diffraction patterns by the reflexion method. Well-rubbed films give patterns of a single layer of mols. axially normal to the surface, the hydrocarbon chains of (I) being more precisely oriented than those of (II), as is the case for unrubbed single layers of mols. of (I) and (II) deposited by the Langmuir-Blodgett method. Thickness of rubbed films on Cr is found, by the Blodgett optical method, to be the same as that of unrubbed single layers of mols. Lightly rubbed films of (I) may be thicker than a single layer, and, after rubbing, the axes of the hydrocarbon chains still stand normal to the surface, but lateral arrangement is less regular. In the case of (II), mols. left on top of the first layer after light rubbing in one direction lie inclined at ~8° to the surface, point against the rubbing direction, and are arranged in crystals having a structure different from that of the film before rubbing; they are completely removed by very light rubbing in the opposite direction.   N. M. B.

Properties and structure of protein films. I. LANGMUIR (Proc. Roy. Inst., 1939, **30**, 483—496). —A lecture.

Spreading of proteins. J. VAN ORMONDT (Chem. Weekblad, 1939, **36**, 262—265).—A survey of published work.   F. L. U.

Very dilute films of proteins. Attempt to determine mol. wts. J. GUASTALLA (Compt. rend., 1939, **208**, 1078—1080).—The surface pressures of very dil. films of ovalbumin (I), hæmoglobin (II), and gliadin (III) on 0·01N-HCl at 19° have been measured as a function of surface concn. The following mol. wts. have been deduced: (I) 40,000; (II) 12,000; (III) 27,000.   W. R. A.

"Surface elasticity" of protein films. I. Egg-albumin. J. B. BATEMAN and L. A. CHAMBERS (J. Chem. Physics, 1939, **7**, 244—250).—The limiting area A_0 and "surface elasticity," $M_s (= -A.dF/dA)$, of egg-albumin films have been measured as a function of the p_H of the substrate. The M_s–F curves are of characteristic form with a well-defined max., $(M_s)_{max}$. A_0 shows a sharp max. near the isoelectric point

(~1·45 sq. m. per mg.), falling off steeply to both acid and alkaline sides and rising again near p_H 2 and 11·7. Such large variations are not manifest in $(M_s)_{max.}$-p_H curves, and for the p_H range studied the observed elasticities are due to a unimol. film of true limiting area ~1·0 sq. m. per mg. The low vals. of A_0 observed at certain vals. of p_H are due to unspread material which does not contribute to the mechanical properties of the film. Tho val. of M_s-F curves for the characterisation of protein films is emphasised.
W. R. A.

Existence of two forms of protein surface films. M. JOLY (Compt. rend., 1939, **208**, 975—976).—Surface films maintained at low pressure during prep. (type A) are characterised by small η and by reversible F-A relations. Type B films, produced when the pressure is allowed to rise during formation, have higher η, which increases to a const. val. in several hr., and rises with temp. Their F-A curves show hysteresis, and the films change reversibly to rigid and elastic two-dimensional gels when subjected to a certain crit. compression. F-A and η curves are affected by change of p_H. Tho two types also differ in electrical properties and in surface concn.
A. J. E. W.

Electric forces at the interface of two dielectrics. B. KAMIEŃSKI (Rocz. Chem., 1938, **18**, 600—613).—The curve relating potential at the air-water interface of aq. org. acids (AcOH, $EtCO_2H$, $PrCO_2H$, BzOH, and salicylic acid) or bases ($CH_2Ph\cdot NH_2$, piperidine, C_5H_5N, α- and β-picoline, collidine, lepidine, and quinaldine) with p_H shows a point of inflexion at a p_H numerically equal to tho pK of the acid or base. In tho case of amphoteric electrolytes the potential-p_H curves pass through a max. or min.
R. T.

Adhesion in detergence. R. C. PALMER and E. K. RIDEAL (J.C.S., 1939, 573—577).—The adhesion of particles of carborundum and $CaCO_3$ (~20 μ.) to SiO_2 surfaces has been studied in presence of dil. solutions of paraffin-chain salts by an adaptation of von Buzágh's method (A., 1929, 645; 1930, 685). Measurements were made with and without hydrophobic coatings on either tho cell walls or the particles. Except when both the cell wall and the particles are clean, adhesion at first decreases with increasing detergent concn., but when micelle formation commences tho adhesion no. increases again. It is concluded that min. adhesion occurs when the particles and the surface are each covered with a unimol. film of detergent, and that at higher concn. the particles are cemented to the surface by a micelle-like structure. In accord with this view the min. adhesion is attained at a lower concn. the greater is the chain-length of the salt, and this concn. is also reduced by addition of NaCl.
J. W. S.

Surface activity of antipyrine and of its 4-alkyl derivatives. A. GIACALONE and D. DI MAGGIO (Gazzetta, 1939, **69**, 122—129).—Solubility and surface tension measurements have been made with aq. solutions of antipyrine and of its Pr^β, Bu^β, and isoamyl derivatives. The surface activity, and probably also the pharmacological action, increases with the length of the alkyl chain. The surface tension data confirm Traube's rule. Pyramidone has a surface activity > that of antipyrine.
O. J. W.

Water-in-oil emulsions. II. Interfacial and surface activities of magnesium and calcium oleates and the rôle played by these soaps in the stabilisation of water-in-oil emulsions. R. C. PINK (J.C.S., 619—621; cf. A., 1938, II, 428).—The prep. of anhyd. *Ca oleate* is described. The effect of various concns. of Mg and Ca oleates in the C_6H_6 on the interfacial tension (γ) between C_6H_6 and H_2O has been studied by the drop-wt. method. The great decrease in γ observed at low oleate concns. is an important factor in the stabilisation of H_2O-in-oil emulsions. The surface tension of H_2O is considerably lowered, and that of C_6H_6 slightly increased, by both salts.
J. W. S.

Permeation, diffusion and dissolution of gases in organic polymerides. R. M. BARRER (Trans. Faraday Soc., 1939, **35**, 628—643).—Permeability consts. (P), diffusion consts. (D), and solubilities (s) have been determined for He, A, H_2, and N_2 in eight rubber-like polymerides. The consts. vary with temp. according to $P = P_0 e^{-E/RT}$, $D = D_0 o^{-E_1/RT}$, and $s = s_0 c^{-\Delta H/RT}$. Vals. of E, E_1, ΔH, D_0, and s_0 are calc. E ranges from 6·5 to 10·7, E_1 from 8·7 to 11·9, and heats of dissolution (ΔH) from —0·5 to —2 kg.-cal. per mol. All the gases for which s could be measured dissolve exothermically. The vals. of s are approx. the same as for the respective gases in org. liquids, but the decrease of entropy is 4—5 units > when they dissolve in liquids, corresponding with the greater restriction of mobility in the polymerides.
F. L. U.

Activated diffusion in membranes. R. M. BARRER (Trans. Faraday Soc., 1939, **35**, 644—656).—Activated diffusions are classified into sp., in which there is special affinity of the solute for the medium (H_2–Pd), and non-sp. which involve van der Waals forces chiefly (He–SiO_2 gel etc.). Data on diffusion of gases in rubber-like polymerides (cf. preceding abstract) are treated theoretically, and elastic displacement on a mol. scale is shown to enable the energy barrier encountered on diffusion to be largely reduced. For such membranes, unlike rigid membranes (inorg. glasses), the activation energy is insensitive to the mol. size of the solute. Vals. of D_0 in the equation $D = D_0 e^{-E/RT}$ for 80 different systems cover a range of ~10^2—10^{-6}, decreasing in the order rubbers > liquids > crystals.
F. L. U.

Dielectric constants of some strong dilute uni-univalent electrolytes at various temperatures. M. WIERZBICKI (Bull. Acad. Polonaise, 1938, **A**, 413—422).—The change in dielectric const. $\Delta\epsilon$ of dil. aq. solutions (0·0005—0·001N.) of LiCl, KNO_3, RbCl, and CsCl at 0° and 10° agrees with the Debye–Falkenhagen theory. At greater concns. (0·002—0·003N.), however, and for all concns. at 18° and 25°, marked deviations from the theory occur. The experimental results can be expressed by $\Delta\epsilon = \Delta\epsilon_{DF} - K\gamma$ ($\Delta\epsilon_{DF}$ = change of D according to theory, and γ = normality of electrolyte), where K is a coeff. increasing with increasing temp. and with the at. no. of the elements Li, K, Rb, and Cs. The data for KNO_3

are identical with those obtained for KCl by Jeżewski (cf. Z. Physik, 1927, **43**, 442). W. R. A.

Viscosity of dilute solutions of o-nitrobenzoic acid. A. BANCHETTI (Annali Chim. Appl., 1939, **29**, 88—90).—In dil. solutions (0·0004—0·01M.), $\eta = 1 + 0·0029\sqrt{c} + 0·392c$, i.e., in accordance with the formula for strong electrolytes (cf. A., 1936, 1336). F. O. H.

Viscosity of dilute solutions of long-chain molecules. II. M. L. HUGGINS (J. Physical Chem., 1939, **43**, 439—456; cf. A., 1938, 1, 616).—Theoretical derivations are given for the general equation relating the η of a dil. solution with the dimensions and arrangement of the atoms in the component mols., and for the special equations applying to rigid chain mols. which are rod-like or are randomly kinked. J. W. S.

Direct observation of emulsification. W. CLAY-TON and J. F. MORSE (Chem. and Ind., 1939, 304—306).—Stages in the formation of emulsions, e.g., formation of drops, then cylinders, and, when $l > \pi d$, globules, are studied by dispersing Wood's metal (Bi 15, Pb 8, Cd 4, Sn 4 pts. by wt.; m.p. 66°) in boiling H_2O, and cooling suddenly. I. C. R.

Problems of stability in hydrophobic colloidal solutions. I. Interaction of two colloidal metallic particles. General discussion and applications. II. Interaction of two colloidal metallic particles : mathematical theory. S. LEVINE (Proc. Roy. Soc., 1939, A, **170**, 145—164, 165—182).—I. The method of calculating the interaction energy of two colloidal particles as a function of their separation is described. The Debye–Hückel theory of electrolytes is used. The electrical forces are found to be repulsive at small separations but to become attractive at large separations. The van der Waals attractive energy is calc. for a particular case; the total energy has a max. val. when the particles are nearly in contact and this max. is the controlling factor in coagulation, its val. diminishing with electrolyte concn. It is shown that the use of the approx. Debye–Hückel equation cannot explain the Schultz–Hardy rule. The energy min. which occurs where the electrical forces vanish is characteristic of all hydrophobic sols containing spherical particles; thixotropy and related phenomena are associated with this min. A method of calculating the osmotic pressure from the interaction energy is indicated. II. Mathematical. G. D. P.

Theory of double refraction of non-spherical colloids in an ultrasonic field. S. OKA (Kolloid-Z., 1939, **87**, 37—43).—Mathematical. Formulæ relating double refraction of dil. suspensions of discoid particles to the intensity (I) of an applied ultrasonic field are derived. Saturation effects are obtained for high vals. of I. F. L. U.

Theory of double refraction in flowing solutions of colloids and large molecules. A. PETER-LIN and H. A. STUART (Z. Physik, 1939, **112**, 1—19).—The existing continuum theory of double refraction in flowing solutions or suspensions is reviewed critically and is further developed for rotation ellipsoids in suspension. Application of the theory to

determination of size, form, and optical consts. of the particles is discussed; limitations of the theory arising from the initial assumptions are indicated. H. C. G.

Determination of size and form, also the electrical, optical, and magnetic anisotropy, of submicroscopic particles by means of induced double refraction and internal friction. A. PETERLIN and H. A. STUART (Z. Physik, 1939, **112**, 129—147).—A theoretical development of previous work (preceding abstract). The treatment embraces particles of mean radius 10—50,000 A. H. C. G.

Influence of frequency on the electro-optical effect in colloids. F. J. NORTON (Physical Rev., 1939, [ii], **55**, 668—669).—A 1% suspension of particles of centrifuged colloidal clay of size ~1500 A., subjected to alternating electric fields of 30—12,000 cycles, showed a very strong Kerr effect (cf. Mueller, A., 1939, 1, 257). There is a min. at 630 cycles, in the case of white and yellow bentonite, at which there is no light-response to the voltage applied. On d.c. at frequencies below the min. there was negative double refraction, and, above the min., positive double refraction. V_2O_5 sol showed a flat frequency characteristic of positive double refraction. N. M. B.

Electro-optical effects in bentonite colloids. H. MUELLER (Physical Rev., 1939, [ii], **55**, 792).—Continuation of work previously reported (cf. A., 1939, 1, 257) shows that a sol of concn. ~1% becomes negatively birefringent for a.c. fields of 60 and 500 cycles. On dilution the effect diminishes rapidly and vanishes at a crit. concn. depending on the field frequency; below the crit. concn. the sols become positively birefringent, results agreeing with those of Norton (cf. preceding abstract). The crit. frequency for the disappearance of birefringence increases with the concn. of the sol. The birefringence consists in general of two parts, one const., and the other vibrating with twice the frequency of the field; both parts vanish at the same concn. For conc. solutions the alternating part is negligible ; for dil. solutions the const. part disappears according to the laws of a relaxation effect. The discovery of the alternating part enables bentonite to be used in light shutters and stroboscopes. N. M. B.

Osmotic pressure of solutions of polysaccharide derivatives. I. New form of osmometer. II. Osmotic pressure of derivatives of lichenin, inulin, glycogen, starch, and starch dextrin. S. R. CARTER and B. R. RECORD (J.C.S., 1939, 660—664, 664—675).—I. An osmometer which works on the counter-pressure principle and is suitable for measurements on materials of mol. wt. 3000—10⁶ dissolved in org. solvents is described. Suitable membranes are prepared by soaking cellulose film prepared by the viscose process ("Viscacelle") in suitable $EtOH-H_2O$ mixtures and then keeping it for ≮4 hr. in abs. EtOH to remove H_2O.

II. The osmotic pressures (Π) of methylated and acetylated lichenin, inulin, glycogens, starches, and starch dextrin have been determined in $CHCl_3$ and CCl_4 solution at various concns. (c). In each case Π increases with increasing c more rapidly than is demanded

by the van 't Hoff law. The deviation is greater for solutions in $CHCl_3$ than for solutions in CCl_4, but in both cases the solutions obey the Ostwald relationship $\Pi = ac + bc^n$, where a, b, and n are consts. for any particular solute and solvent. By extrapolating the curves of Π/c against c to $c = 0$ the particle wts. are deduced. These are $\gg$ the size of the fundamental chains as determined by Haworth's end-group method except in the cases of inulin and perhaps lichenin, where the units are identical.

J. W. S.

Dependence of flow of benzopurpurin sols on dimensions of capillary. W. Z. DANEŠ (Kolloid-Z., 1939, **87**, 43—57).—Measurements of the apparent η of 0·75% sols of benzopurpurin 4B were made at 18° at different rates of flow (v) in capillaries 1·5—54 cm. long and 0·04—0·09 cm. in diameter. The changes in η at high v are attributed to disintegration of the particles. The apparent η tends to a const. val. in long and narrow capillaries at high v.   F. L. U.

Plastic flow of dispersions and a new approach to the study of plasticity. P. S. ROLLER (J. Physical Chem., 1939, **43**, 457—489).—The plastic resistance of dispersions is distinguished from the viscous resistance, which depends on rate of deformation, and hence measurement of plasticity on the basis of viscous resistance is deemed to be wrong in principle. The plasticity of a no. of dispersions has been studied by measurement of the plastic flow, in which two const. factors are identified, the coeff. of retinence ($\varkappa$) and yield val. (p_0). $\varkappa$ is of the greater importance in determining the stress at practical deformations and is const. for any particular system, whereas p_0 varies with the concn. of liquid present. Liquid retention is defined as the % of liquid phase present at a specified yield val., and generally increases with increase of plasticity. The view that the rigidity of a dispersion is due to the total force of attraction between the particles of the disperse phase is supported by the observation that variations in intrinsic attractive force, electrokinetic potential, solvation, dispersivity, and particle shape affect the plasticity and cohesion in the manner anticipated.   J. W. S.

Viscosity of agar and saponin mixtures. R. G. RUYSSEN and J. ROWAN (Natuurwetensch. Tijds., 1939, **21**, 76—78).—η has been measured for 0·1% agar and saponin sols and various mixtures at p_H 3·3, 5·0, 7·5, and 8·5. Although both sols are negatively charged the vals. for η are < additive, especially in acid media (p_H 5·0 and 3·3). In no case was coacervation observed even on addition of 5% of EtOH.   S. C.

Atom groups in radio-colloids. (MLLE.) C. CHAMIÉ (Compt. rend., 1939, **208**, 1300—1301; cf. A., 1931, 591).—After prolonged centrifuging, solutions of Po in conc. HCl still contain groups of Po atoms, which are detected photographically after deposition on a layer of paraffin wax; such groups are not obtained in solutions of radio-crystalloids (Th active deposit). It is suggested that formation of radio-colloid aggregates in solvent media is governed by a probability law, so that even in strongly acid solutions the probability of formation of Po aggregates is finite.   A. J. E. W.

Colloidal complex cyanides of heavy metals. O. C. HUIN (J. Chim. phys., 1939, **36**, 62—70).—Contrary to present ideas, insol. ferrocyanides (Fe^{III}, Ag, Cu, and UO_2), ferricyanides (Cu and Ag), and ruthenocyanides (Cu) produced by pptn. are not at any stage pure substances of simple composition. Their composition varies continuously with changes in the relative proportions of reactants and even with dilution of the reagents. The pptd. Cu and Ag ferricyanides show less variation in composition than do the ferrocyanides and ruthenocyanide and their colloidal properties are less marked.   F. H.

Presence of two types of micelle in aqueous solutions of soaps. J. STAUFF (Naturwiss., 1939, **27**, 213—214).—Change of aggregation of micelles in aq. solutions of soaps can be detected by X-ray investigations and by determining the velocity of formation of nuclei with respect to concn. X-Ray photographs of 0·25N-Na palmitate solutions at 70° show the existence of rings of smaller diameter than those due to solid Na palmitate. Below this concn. the rings disappear; above it they increase in intensity with concn. The X-ray interference is produced by colloid particles, and it is inferred that at concns. >0·25N. two types of particle are present. The curve of velocity of crystal formation against concn. shows a definite change of direction between 0·1 and 0·25N., which is ascribed to a change in the state of aggregation. The formation of " large " and " small " micelles is discussed.   A. J. M.

Influence of silicates on the effectiveness of dilute aqueous detergents in forming thermodynamically stable colloidal solutions of otherwise insoluble dyestuffs. J. W. McBAIN and T. M. WOO (Kolloid-Z., 1939, **87**, 74—78).—Addition of various brands of Na silicate to an aq. solution of a detergent raises the " dye no." (cf. A., 1938, I, 194), i.e., modifies the distribution of an insol. dye between an org. solvent and the aq. phase in favour of the latter. The distribution is also affected by the p_H, 10·6—10·7 being the val. most favourable to aq. solubility. The materials used were Turkey-red oil, PhMe, and aq. solutions of various detergents.

F. L. U.

Solubility of celluloses in alkalis.—See B., 1939, 470.

Solubility and swelling of high polymerides. J. N. BRÖNSTED and K. VOLQVARTZ (Trans. Faraday Soc., 1939, **35**, 576—579).—A study of equilibria in systems consisting of a highly polymerised polystyrene fraction as one component and Et, Pr^α, Pr^β, Bu^α, Bu^β, or isoamyl laurate as the other shows that the phases in equilibrium are a swelled mixture and a pure component (ester). There is evidence of a crit. temp. at which the solubility of ester in the swelled phase is infinite. The entropy of swelling is negative.   F. L. U.

Highly polymerised compounds. CCXI. Solubility of substances of high mol. wt. VI. State of the solvent in the system acetone–cellulose nitrate at low and high concentrations (0·1 to 75%). G. V. SCHULZ (Z. physikal. Chem., 1939, **184**, 1—41).—At low concns. [0·1—5% of cellulose

nitrate (I)] the entropies of dilution and mixing are the same, and the normal behaviour of such solutions enables mol. wt. determinations to be made. The free energy of the solvent, ΔF, decreases with increasing mol. wt. of (I) at such concns., but at higher concns. (20—75%) ΔF is independent of the mol. wt. and depends solely on the concn. The ratio of the heat of dilution, Δw, to ΔF increases from 0·9 for low concns. to 1·20 for high concns. and is ~1·0 for 33—55% of (I). This range of high concns. (20—75%) can be further divided at 45% of (I) since below this concn. log Δw is $\propto$ concn., whereas above 45% log Δw increases much more rapidly. The data are discussed with reference to theories of solvation.
C. R. H.

Lyophilic properties of cellulose and its derivatives. V. Dependence of surface charge of viscose on age. K. KANAMARU, T. KOBAYASI, and M. SEKI (Kolloid-Z., 1939, I, 62—68; cf. A., 1937, I, 360).—The surface charge on viscose sols changes from negative to positive at about the time when the η of the sols reaches a min. Both properties are affected in the same sense by changes in composition. The results are in better agreement with the view that the ripening process consists in desolvation than with that which regards it as a homogenisation due to delayed xanthation.
F. L. U.

Mol. wt., unimolecular layers, and general structure of proteins. G. T. PHILIPPI (Chem. Weekblad, 1939, 36, 266—274).—An account and discussion of published work.
F. L. U.

"Intraglobular" reactions and the cyclol structure of proteins. N. GRALÉN and T. SVEDBERG (Nature, 1939, 143, 519—520).—The sedimentation const. of the ovalbumin–diketopiperazine complex is $3·62 \times 10^{-13}$, which is slightly > the val., 3·55, for ordinary ovalbumin (I). The diffusion const. is $6·6 \times 10^{-7}$ as compared with $7·76 \times 10^{-7}$ for (I). This reduction indicates an increase in vol. of the particle, probably by interaction between the glycine ester and the free NH_2 or CO_2H on the surface of the protein mol. Talmud's experiments (A., 1939, II, 42) thus do not support the cyclol hypothesis of protein structure.
L. S. T.

Influence of salts on the m.p. of gelatin jellies. J. H. C. MERCKEL and P. W. HAAYMAN (Kolloid-Z., 1939, 87, 59—62; cf. A., 1937, I, 240).—The m.p. of a 10% gelatin jelly is lowered by Na salts in the increasing order : $Cl' < BrO_3' < ClO_3' < Br' < NO_3' < I' < CNS'$, and is raised by H_2PO_2', the effect in every case increasing linearly or nearly so with concn. A quant. relationship between lyotropic no. and the salt concn. needed to reach a given m.p. is found, similar to that observed for swelling (*ibid.*, 564).
F. L. U.

Lyotropic series. II. Adsorption of salts on gelatin. A. R. DOCKING and E. HEYMANN (J. Physical Chem., 1939, 43, 513—529).—The adsorption of salts on isoelectric gelatin follows the order $KCNS > KI > KBr > KNO_3 > KCl > KOAc > K$ tartrate $= K_2SO_4$, $LiI > LiBr > LiCl > Li_2SO_4$, $LiCl > NH_4Cl > NaCl > KCl$, and $BaCl_2 > CaCl_2 > SrCl_2 > MgCl_2$; and ranges from strong positive adsorption with I', CNS', and $Cu^{..}$ to strong negative adsorption with $(NH_4)_2SO_4$, $MgSO_4$, K_2SO_4, and Li_2SO_4. The solubility of gelatin is decreased by K_2SO_4 and KOAc and increased by other salts in the order $KCl < KBr < KNO_3 < KCNS$. Alkaline-earth chlorides increase the solubility in the order $MgCl_2 < CaCl_2 < SrCl_2 < BaCl_2$, but alkali-metal chlorides all have an equal effect. From the negative adsorption of sulphates the min. hydration of gelatin is calc. to be 0·6—0·7 g. of H_2O per g. The results are in accord with Katz's theory (A., 1933, 462).
J. W. S.

Electrical conductance of sols and gels and its bearing on the problem of gel structure. I. Gelatin. R. TAFT and L. E. MALM (J. Physical Chem., 1939, 43, 499—512).—A gradual decrease in conductivity (κ) occurs during the sol–gel change in gelatin (I) at 25° and 30°, the max. changes being +4 —8%. No abrupt change is observed. The κ of aq. KCl and KCNS is reduced by the presence of (I), but, excepting at very low concn., is the same in both the sol and gel states. This result is interpreted as evidence in favour of the fibrillar structure of (I) gels. KCNS shows a relatively greater decrease in κ in presence of (I) than does KCl, indicating a greater adsorption of the CNS' ion.
J. W. S.

Elasticity and viscosity of highly polymerised compounds. W. KUHN (Angew. Chem., 1939, 52, 289—301).—A general theoretical discussion. The properties in question are determined by the magnitudes of the partial moduli of elasticity and the relaxation times (λ) of the various species present. Highly polymerised compounds are distinguished from simpler substances by the much wider range of λ vals. pertaining to the former.
F. L. U.

Molecular assemblage and crystallite orientation as causes of rubber-like elasticity. W. KUHN (Kolloid-Z., 1939, 87, 3—12; cf. A., 1938, I, 558).—Mathematical. The observed modulus of elasticity of a substance containing both flexible filamentous mols. and rigid rod-shaped crystallites is the sum of a no. of partial moduli, that due to the tendency to thermal disorientation of the crystallites being $E = 9RTp/5M$ (p = wt. of crystallites per c.c., M = their mean mol. wt.).
F. L. U.

Borrowed periodicities derived from the spontaneous periodic precipitation of silver chromate by localised substitution. S. VEIL (Bull. Soc. chim., 1939, [v], 6, 700—702).—A phenomenon similar to that already reported (A., 1938, I, 455) occurs when a mixed solution of $AgNO_3$ and $Pb(NO_3)_2$ is placed on gelatin impregnated with K_2CrO_4, the rings of Ag_2CrO_4 first formed being replaced by $PbCrO_4$.
F. J. G.

Supersaturated solutions of metallic silver. II. R. E. LIESEGANG (Z. wiss. Phot., 1938, 37, 259—261; cf. A., 1939, I, 78).—Diffusion of $AgNO_3$ into gelatin gels containing $FeSO_4$ gives a uniform black colour when the $FeSO_4$ is dil., as the $AgNO_3$ is not hindered by reduction, but with more conc. $FeSO_4$ various bandings up to the limiting case of palest orange colouring. It appears probable that very high supersaturation of Ag is possible in some cases without nuclei; this is of course not the case in photography.
J. L.

Formation of spirals in precipitates in jellies. R. E. LIESEGANG (Kolloid-Z., 1939, **87**, 57—58).— Examples of spiral pptn. are given and its causes discussed.　　　F. L. U.

Variation of cataphoretic velocity of silver halides in presence of dyestuffs. M. K. INDRA (J. Indian Chem. Soc., 1939, **16**, 15—18).—The cataphoretic velocity v of AgX (X = Cl, Br, I) generally increases with increasing amounts of acidic indicators (eosin, fluorescein, Me-violet). The time lag observed before the attainment of the final v is discussed.　　　W. R. A.

Relationship of skin permeability to electrophoresis of biologically active materials into the human living skin.—See A., 1939, III, 514.

Electro-osmosis in gelatin as a function of the concentration of the gel and the nature of the combined ion. J. SWYNGEDAUW (Compt. rend. Soc. Biol., 1939, **130**, 62—64).—The quantity of H_2O transported by the ion ($Na^{\cdot}$, $K^{\cdot}$, or $Li^{\cdot}$) decreases as the concn. of the gel increases and at a high concn. of gelatin is of the order of the coeff. of the hydration of the ion.　　　H. G. R.

Streaming potentials on barium sulphate and ion antagonism. R. RUYSSEN (Natuurwetensch. Tijds., 1939, **21**, 79—90).—Negative $BaSO_4$ crystals suitable for streaming potential measurements are prepared by slow pptn. from $BaCl_2$ and K_2SO_4 solutions at a high dilution. The electrokinetic potential curve for $BaCl_2$ shows the typical course of adsorption of an ion determining the potential. At low concns. there is antagonism between KCl and $BaCl_2$, which cannot be explained on ionic activity. At higher concns. excess of KCl has a discharging effect and desorption and replacement of the $Ba^{\cdot\cdot}$ ion must be assumed.　　　S. C.

Study by the Raman effect of the balanced reactions in formation of mercuric chlorobromide and bromocyanide. (MLLE.) M. L. DELWAULLE (Compt. rend., 1939, **208**, 999—1002).—The following vals. of equilibrium consts. for the reactions $HgBr_2 + HgX_2 \rightleftharpoons 2HgBrX$ are deduced by a Raman method, which is described : X = Cl, $2\cdot0\pm0\cdot2$; CN, $\sim0\cdot2$. HgBrCN does not exist in the cryst. state.　　　A. J. E. W.

Reduction of cuprous and cobalt chlorides by deuterium. J. R. PARTINGTON and R. P. TOWNDROW (Trans. Faraday Soc., 1939, **35**, 553—559).— Equilibrium consts. for each of the four reactions H_2 (D_2) + Cu_2Cl_2 ($CoCl_2$) $\rightleftharpoons$ 2HCl (DCl) + 2Cu (Co) have been determined between 400° and 500°. Vals. of K for the homogeneous reaction $2DCl + H_2 \rightleftharpoons 2HCl + D_2$ are calc. from the results and compared with data from other sources. Vals. of ΔU for the reductions are also calc.　　　F. L. U.

Reactions of tertiary bases with polyhalogenoparaffins.—See A., 1939, II, 238.

Measurement of p_H by means of the glass electrode and the hydrolysis of copper sulphate. H. HAGISAWA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 275—284).—A standard buffer solution and a given solution are placed respectively in the inner and outer parts of the glass bulb, and then reversed, thus eliminating the asymmetric potential of the glass electrode. The relationship between p_H and dilution (V) of the $CuSO_4$ is given by $p_H = 3\cdot5200 + 0\cdot6717$ log V.　　　D. F. R.

Reduction of the alkalinity of hypochlorite solutions with sodium hydrogen carbonate. A. OSOL and J. R. COX (J. Amer. Pharm. Assoc., 1939, **28**, 148—151).—Determinations of the p_H of aq. NaOH- and Na_2CO_3–$NaHCO_3$ preps. indicate that the alkalinity (due to NaOH) of aq. NaOCl is reduced by $NaHCO_3$ owing to formation of Na_2CO_3 and not to suppression of the ionisation of NaOH by the added $Na^{\cdot}$.　　　F. O. H.

" Acids " and " bases " in liquid melts. Determination of oxygen-ion concentration. H. LUX (Z. Elektrochem., 1939, **45**, 303—309).—The p.d. between a Rh and a Au electrode in a eutectic of Na_2SO_4–K_2SO_4 at 950° has been measured during the addition of increasing amounts of Na_2O. Measurements with strongly alkaline melts could not be made owing to attack of the crucible. Even with less alkaline melts the data are qual. only, on account of the vaporisation of Na_2O. The experimental difficulties are described and the data are briefly discussed in reference to the definition " base " $\rightleftharpoons$ " acid " + O".　　　C. R. H.

Titration curve of methionic acid. P. M. BREWSTER and G. L. JENKINS (J. Amer. Pharm. Assoc., 1939, **28**, 144—146).—The acid behaves as a strong, dibasic acid, analogous to H_2SO_4; a break in the curve at p_H 11—11·5 is probably due to decomp. or mol. rearrangement.　　　F. O. H.

Thermodynamic dissociation constants of oxalic acid. H. N. PARTON and R. C. GIBBONS (Trans. Faraday Soc., 1939, **35**, 542—545).—From measurements on cells of the type Pt|quinhydrone (saturated), $H_2C_2O_4$ (m_1), KHC_2O_4 (m_2), KCl (m_3)|AgCl|Ag and Pt|quinhydrone (saturated), KHC_2O_4 (m_1), $K_2C_2O_4$ (m_2), KCl (m_3)|AgCl|Ag the second dissociation const. of $H_2C_2O_4$ at 25°, 30°, and 35° is calc. as 5·012, 4·787, and 4·488 × 10^{-5}, respectively, and the first dissociation const. as $\sim0\cdot050$ at 25°.　　　J. W. S.

Thermodynamic dissociation constants of oxalic acid in water and methanol–water mixtures. H. N. PARTON and A. J. C. NICHOLSON (Trans. Faraday Soc., 1939, **35**, 546—550; cf. preceding abstract).—The e.m.f. between H electrodes and Ag–AgCl electrodes have been measured in solutions containing various concns. of $NaHC_2O_4$, $Na_2C_2O_4$ (or $H_2C_2O_4$), and NaCl in H_2O and in 10% and 20% aq. MeOH. In aq. solution the first dissociation const. is 0·0457, 0·0550, and 0·0531 at 25°, 30°, and 35°, respectively, and hence has probably a max. val. at $\sim32°$. The dissociation consts. in H_2O–MeOH mixtures at 25° are in approx. agreement with theory.　　　J. W. S.

Dissociation constants of isomeric halogeno- and nitro-benzoic acids. H. O. JENKINS (J.C.S., 1939, 640—643).—It is shown that for each of these series of acids the thermodynamic dissociation const. of the substituted acids (K_s) is related to the dissociation const. of BzOH (K_u) and the electrical intensity

at the O·H bond due to the substituent dipole (F) by the relation $\log_e K_s = \log_e K_u - \beta F$. β is a const. for any substituent, but varies with the nature of the substituent. Accord with this law indicates that o-acids have normal dissociation consts.   J. W. S.

Dielectric properties and ionisation constants of amino-acids. W. CARR and W. J. SHUTT (Trans. Faraday Soc., 1939, **35**, 579—587; cf. A., 1938, I, 245).—ϵ has been measured for aq. solutions of glycine, glycylglycine, alanine, and $NH_2 \cdot [CH_2]_5 \cdot CO_2H$ over a p_H range extending to either side of the iso-electric points, and acid and basic dissociation consts. have been calc. from the results. Similar measurements with taurine and p-$NH_2 \cdot C_6H_4 \cdot SO_3H$ indicate that these exist entirely as zwitterions only over a very narrow p_H range.   F. L. U.

Activity coefficient of strong electrolytes in concentrated solutions. II. S. ABE (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 260—274; cf. A., 1937, I, 411).—Activity coeffs. calc. according to a previously published theory are compared with experimental results in the cases of NaCl, HCl, $ZnSO_4$, and $CaCl_2$.   D. F. R.

Activity coefficients of ammonium chloride in liquid ammonia at 25° H. W. RITCHEY and H. HUNT (J. Physical Chem., 1939, **43**, 407—416).—The difference in v.p. between pure liquid NH_3 and solutions of NH_4Cl in NH_3 (0·005—0·9M.) has been measured at 25°, and the activity coeff. of NH_4Cl deduced. The results accord with the Debye–Hückel theory only at very low concns. Combining the results with e.m.f. measurements and the free energies of formation of NH_4Cl, TlCl, and NH_3 (A., 1934, 735; 1936, 31), the standard potentials of Tl|TlCl, Zn|$ZnCl_2,6NH_3$, and Cd|$CdCl_2,6NH_3$ electrodes at 25° are deduced.   J. W. S.

Cacodylates of zinc. III. Properties. R. TIOLLAIS and H. PERDREAU (Bull. Soc. chim., 1939, [v], **6**, 631—638; cf. A., 1938, I, 455).—The solubility curve of $Zn(Me_2AsO_2)_2$ has been determined. The stable solid phases are heptahydrate below 25°, monohydrate from 25° to approx. 60°, and anhyd. salt at higher temp. At room temp., dehydration of the heptahydrate affords monohydrate in an atm. of 6·3—11 mm. of H_2O vapour and anhyd. salt in an atm. of <2·5 mm. In air, the heptahydrate affords the monohydrate at 25°, and this affords the anhyd. salt at 40°.   F. J. G.

Cacodylates of cadmium. R. TIOLLAIS, H. PERDREAU, and L. BERTHOIS (Bull. Soc. Chim., 1939, [v], **6**, 638—646).—*Cd cacodylate*, $Cd(Me_2AsO_2)_2$, and *hydrates* with 1, 2, 7, and $10H_2O$ have been obtained. The solubility curve has five sections representing the stability ranges of the hydrates and the anhyd. salt, viz., <14°, 14—22°, 22—51°, 51—56°, and >56°. On exposure to air at room temp. the higher hydrates afford dihydrate, whilst at 43° and 50° the products are monohydrate and anhyd. salt, respectively. The partial pressures of H_2O under which the hydrates are stable at room temp. are as follows: $10H_2O$, 13·3—13·9 mm.; $7H_2O$, 12·7—13·3 mm.; $2H_2O$ ~1—12·7 mm.; $1H_2O$ ~0·1—1 mm.   F. J. G.

Solubility curves of boric acid and sodium borates. W. C. BLASDALE and C. M. SLANSKY (J. Amer. Chem. Soc., 1939, **61**, 917—920).—The aq. solubilities of H_3BO_3, $Na_2B_4O_7, xH_2O$ ($x = 10, 5, 4$), $NaB_5O_8, 5H_2O$, and $NaBO_2, xH_2O$ ($x = 4, 2$) have been determined at 5° intervals between 0° and 100°. The transition temp. of the various hydrates are $Na_2B_4O_7$: $10 \rightarrow 5H_2O$, metastable, 60·8°; $10 \rightarrow 4H_2O$, stable, 58·5°; $NaBO_2$: $4 \rightarrow 2H_2O$, stable, 54°. $NaB_5O_8, 5H_2O$ readily forms supersaturated solutions above ~2° and is still stable at temp. considerably <2° in presence of a slight excess of Na_2O.   W. R. A.

Thermal equilibrium between niobium tetroxide and water. P. SÜE (Compt. rend., 1939, **208**, 1088—1090).—The reaction, $Nb_2O_4 + H_2O \rightleftharpoons Nb_2O_5 + H_2 + Q$, has been investigated between 985° and 1170°; it is completely reversible. The mean val. of Q is 18·2 kg.-cal. The heat of formation of Nb_2O_4 has been computed as 387 kg.-cal.   W. R. A.

System FeO–TiO$_2$. J. GRIEVE and J. WHITE (J. Roy. Tech. Coll., 1939, **4**, 441—448).—Thermal analysis and microscopic examination show that the system includes two compounds, $2FeO,TiO_2$ (pseudo-brookite) and FeO,TiO_2 (ilmenite), and three eutectics. The formation of the compounds has been confirmed by X-ray methods, which also indicate that the TiO_2 separates out from the melts as rutile.   T. H. G.

Hydrogenation and atomic exchange of benzene. R. K. GREENHALGH and M. POLANYI (Trans. Faraday Soc., 1939, **35**, 520—542).—The hydrogenation and at. exchange reactions of C_6H_6 with H_2–D_2 mixtures, and the equilibration of *para*-H on Pt, Ni, and Cu surfaces have been studied in both the liquid and gaseous phases. The mechanisms of the changes are discussed and the results are compared with those obtained with C_2H_4 (A., 1937, I, 469).   J. W. S.

Systems chrysene–1 : 2-benzanthracene and 1 : 2-benzanthracene–triphenylene. M. G. STURROCK and T. LAWE (Canad. J. Res., 1939, **17**, B, 71—74).—The liquidus–solidus curves of the systems are given. They provide a convenient method for the evaluation of the % composition of these mixtures.   D. F. R.

Ternary systems of liquids showing component separation phenomena. E. JÄNECKE (Z. physikal. Chem., 1939, **184**, 59—85).—Phase diagrams for binary and ternary mixtures of C_6H_{14}, $HCO \cdot NH_2$, and $PhNO_2$ have been constructed and are discussed with reference to the general analysis of phase diagrams of heterogeneous liquid mixtures.   C. R. H.

System mercuric cyanide–mercuric chloride–methyl alcohol. Formation of an additive compound of mercuric chloride and methyl alcohol, and detection of a chlorocyanide by the Raman effect. F. FRANÇOIS (Compt. rend., 1939, **208**, 1002—1004).—The ternary solubility curves for the system at 14° and 50° consist of two branches corresponding with deposition of $Hg(CN)_2$ and $HgCl_2$ (50°) or $HgCl_2, 1 \cdot 5MeOH$ (I) (14°); no mixed crystals occur (cf. A., 1938, I, 518). (I) loses MeOH in an atm. free from the vapour; $HgCl_2$ absorbs MeOH from the-

saturated vapour. MeOH solutions of $HgCl_2$ + $Hg(CN)_2$ give Raman lines due to $HgCl_2$, $Hg(CN)_2$, and HgClCN (304, 346 cm.$^{-1}$).   A. J. E. W.

B.p. depression by non-volatile substances in ternary systems. II. Behaviour of concentrated solutions of cobaltous chloride and sodium nitrate in water. M. CENTNERSZWER and (MLLE.) H. ŁADZIŃSKA. **III. Concentrated solutions of calcium nitrate in water.** M. CENTNERSZWER and (MLLE.) K. ŻOŁĄTKOWSKA. **IV. Properties of "isozeonic" solutions.** M. CENTNERSZWER (Bull. Acad. Polonaise, 1938, A, 438—448, 449—455, 456—465; cf. A., 1936, 936).—II. The addition of various non-volatile third components to a conc. aq. solution of a hydrate-forming salt lowers the mol. b.p. elevation until beyond a crit. concn. the b.p. is actually depressed. There must, therefore, for each such third component, be a crit. concn. which produces no alteration of b.p.; this yields an "isozeonic" solution, the composition of which depends on the nature of the third component. Non-hydrated third components do not display this behaviour. Whilst aq. $CoCl_2$ solutions to which LiCl, NaCl, KCl, $BaCl_2$, $NiCl_2$, and glucose are added display the above behaviour, an aq. solution of $NaNO_3$ does not, as is to be expected since it does not form a hydrate. Results contrary to theory were found for aq. $Na_2S_2O_3$, probably because the concns. of third component were not sufficiently high.

III. The influence of addition of KNO_3, $NaNO_3$, and glucose on the b.p. of conc. aq. $Ca(NO_3)_2$ has been studied in terms of the formation of "isozeonic" solutions.

IV. The representation and thermodynamics of "isozeonic" solutions are discussed.   W. R. A.

Reciprocal salt pair $CoSO_4$ + $(KCl)_2$ = $CoCl_2$ + K_2SO_4. I. A. BENRATH and G. RITTER (J. pr. Chem., 1939, [ii], **152**, 177—189).—The 0°, 38°, 50°, 75°, and 99·5° isotherms for the system have been determined. In addition to known compounds, $CoCl_2,KCl,2H_2O$ and $CoSO_4,K_2SO_4,4H_2O$ occur as solid phases.   F. J. G.

Isomorphous replacement in hydrated salts. I. Systems $CoCl_2$–$CuCl_2$–H_2O ; $CdCl_2$–$NiCl_2$–H_2O ; $CdCl_2$–$CoCl_2$–H_2O. H. BASSETT, J. H. HENSHALL, G. A. SERGEANT, and R. H. SHIPLEY. **II. System $NaCl$–$CdCl_2$–H_2O and the formation of solid solutions in the systems $NaCl$–$CdCl_2$–$NiCl_2$–H_2O and $NaCl$–$CdCl_2$–$CoCl_2$–H_2O.** H. BASSETT, J. H. HENSHALL, and G. A. SERGEANT (J.C.S., 1939, 646—653, 653—660).—I. The system $CoCl_2$–$CuCl_2$–H_2O at 25° shows only the hydrates $CoCl_2,6H_2O$ and $CuCl_2,2H_2O$. The system $CdCl_2$–$NiCl_2$–H_2O at 25° shows the hydrates $CdCl_2,2\cdot5H_2O$, $CdCl_2,H_2O$, and $NiCl_2,6H_2O$ and the double salts $4CdCl_2,NiCl_2,10H_2O$, $2CdCl_2,NiCl_2,12H_2O$, $2CdCl_2,NiCl_2,6H_2O$, and $3CdCl_2,2NiCl_2,14H_2O$ of invariant composition. There are also two series of solid solutions. The system $CdCl_2$–$CoCl_2$–H_2O at 25° contains the hydrates $CoCl_2,6H_2O$, $CdCl_2,2\cdot5H_2O$, and $CdCl_2,H_2O$, and the double salts $4CdCl_2,CoCl_2,10H_2O$ and $2CdCl_2,CoCl_2,12H_2O$. A metastable phase of composition $CdCl_2,2CoCl_2,12H_2O$ may be an end no.

of a series of solid solutions, as in the corresponding Ni compound. Solid solutions of the type $(Cd,Co)Cl_2,2\cdot5H_2O$, corresponding with the second series of solid solutions with the Ni system, can be obtained only in presence of NaCl.

II. Large amounts of NaCl can enter isomorphously into solid solutions of the type $(Cd,Ni)Cl_2,2\cdot5H_2O$ until all the Ni and some of the Cd have been replaced. The replacement is also accompanied by a steady decrease in the H_2O content and the final result is the compound $2NaCl,CdCl_2,3H_2O$, also found as a double salt in the system $NaCl$–$CdCl_2$–H_2O. Similar behaviour is found when Ni is replaced by Co, but the solid solutions $(Cd,Co)Cl_2,2\cdot5H_2O$ cannot be obtained free from Na. The structures of the various double salts are discussed. The system $NaCl$–$CdCl_2$–H_2O also indicates the existence of the *compound* $3NaCl,4CdCl_2,14H_2O$.   J. W. S.

System CaO–P_2O_5–$NaOH$–H_2O. P. SCHLÄPFER and R. LEHNER (Przemysł Chem., 1938, **22**, 482—490).—A nephelometric method allowing the determination of 10—450 g. of Ca is described; it depends on pptn. of Ca as oleate from buffered aq. gelatin. Electrometric and X-ray studies show that the only stable solid phase forming in the system CaO–P_2O_5–$NaOH$–H_2O at $p_H ≮ 5\cdot9$ is $3Ca_3(PO_4)_2,Ca(OH)_2$ (I), which readily adsorbs $Ca^{..}$ from alkaline, and PO_4''' from acid, solutions. The solubility of (I) in H_2O and aq. NaOH at 20—350° was determined; it falls with rising [NaOH].   R. T.

Calorimetry and thermochemistry. W. A. ROTH (Z. Elektrochem., 1939, **45**, 335—343).—A review of recent work.

Calculation of heat of reaction from equilibrium constants at two temperatures ; new heats of ionisation of organic acids. A. W. WALDE (J. Physical Chem., 1939, **43**, 431—438).—The equations of Douglas and Crockford (A., 1935, 304) are extended to apply to reactions for which the heat of reaction is expressed by $\Delta H = a + bT + cT^2 + dT^3 + eT^4$. The theory is applied to the calculation of the heats of ionisation of org. acids from their dissociation const. (K). No general relation exists between ΔH and K; the relationships in isolated series are discussed. Resonance energy increases ΔH for certain substituted benzoic acids.   J. W. S.

Equilibrium $P_4 \rightleftharpoons 2P_2$ in phosphorus vapour. G. WÉTROFF (Compt. rend., 1939, **208**, 903—905).—The heat of dissociation (q) of P_2 into atoms, as deduced from the band spectrum, is 115·45 kg.-cal., and hence the concn. of P atoms at 1200° is negligible. From the results of Preuner and Brockmöller (A., 1912, ii, 1145) it is deduced that q for $P_4 \rightarrow P_2$ at 1000—1200° is 41 kg.-cal. Taking 45±4 kg.-cal. as a mean val. for q at this temp., the val. for 0° K. is 50±4 kg.-cal. The heats of evaporation of white and red P into P_4, P_2, and P are also deduced.   J. W. S.

Heat of dilution in the system caoutchouc-toluene. K. H. MEYER, E. WOLFF, and C. G. BOISSONAS (Przemysł Chem., 1938, **22**, 441—444).—The heat of dilution of solutions of caoutchouc in

PhMe is derived from the temp. coeff. of the osmotic pressure of such solutions, for the range 24·4—35·6°.   R. T.

Heat of vaporisation of water at 80° from aqueous phosphoric acid of various concentrations. K. I. ZAGVOZDKIN (J. Appl. Chem. Russ., 1938, **11**, 1543—1547).—The latent heat of vaporisation of H_2O rises from 553·5 for 12·65% to 583·5 g.-cal. per g. for 58·22% H_3PO_4, and the heat of dilution rises over the same concn. range from 0·9 to 30·9 g.-cal. per g.   R. T.

Heat of hydrolysis of sulphur monochloride. A. C. BATALIN and I. A. SCHTSCHERBAKOV (J. Gen. Chem. Russ., 1938, **8**, 1394—1398).—The heat of hydrolysis of S_2Cl_2 at 24·881° is 35 kg.-cal. per g.-mol. The reaction is of the first order when the $[H_2O]$ is $>30[S_2Cl_2]$.   R. T.

Entropy of ionisation in solutions of low dielectric constant. E. SWIFT, jun. (J. Amer. Chem. Soc., 1939, **61**, 973).—Consideration of recorded data (cf. Bent et al., A., 1938, I, 142 ; Swift, ibid., 401) on the conductivity of various org. compounds in Et_2O indicates that a generalisation about the constancy of ΔS in Et_2O cannot be made except when the ions compared are of approx. the same diameter.   W. R. A.

Extrapolation of conductance data for the univalent nitrates and iodates by means of the extended Onsager–Shedlovsky equation. A. R. GORDON (J. Chem. Physics, 1939, **7**, 221—222).— Mathematical. The extended Onsager–Shedlovsky equation (cf. A., 1934, 735) allows the extrapolation of conductance data for uni-univalent nitrates and iodates. Anomalies in the conductance of these salts at low concns. are explained.   W. R. A.

Electrical conductivities of dilute solutions of sodium dodecyl sulphate in ethyl alcohol–water mixtures at 20°. A. F. H. WARD (J.C.S., 1939, 522—530).—The equiv. conductivities (Λ) of 0·0001— 0·01M. solutions of $C_{12}H_{25} \cdot SO_4Na$ in various $EtOH$–H_2O mixtures have been determined at 20°, and the val. of Λ_0 for each mixture of solvents is derived. Walden's rule $(\Lambda_0 \eta = const.)$ is approx. obeyed by the $C_{12}H_{25} \cdot SO_4'$ ion but not by the $Na^{\cdot}$ ion. The solvation of the ions has been estimated by various methods. Plots of Λ against $\sqrt{c}$ $(c = concn.$ of solute) yield straight lines at low vals. of c. The slope of these lines is in accord with the val. deduced from the Onsager equation except in mixtures containing 80—100% of $EtOH$, where the solute is incompletely ionised, or 10—50% of $EtOH$, where the observed slopes are abnormally low. Over this latter range of $[EtOH]$ the solubility of $C_{12}H_{25} \cdot SO_4Na$ is very high, probably owing to the presence of both hydrophilic and hydrophobic groups in the solute mol.   J. W. S.

Equivalent conductivity of sodium cholestenonesulphonate. E. KUHR (Ber., 1939, **72**, [B], 930—932).—With increasing concn., Λ falls off rapidly to a min. at 0·02—0·04N., then slowly increases to a max. at ~0·3N., and then again decreases slowly.   F. J. G.

Transport number, conductivity, and viscosity of solutions of hydrogen chloride in mixed

solvents. I. I. SHUKOV and G. F. DNEPROV (J. Gen. Chem. Russ., 1938, **8**, 1476—1482).—The transport no. of Cl' in aq. org. solvents (0·1N·HCl) rises as the [EtOH] exceeds 10 and the $[(CH_2 \cdot OH)_2]$ 20 mol.-%, but is not affected by glycerol (up to 35%). The η of the aq. solvents is lowered by addition of HCl. The conductivity falls with increasing concn. of org. solvents.   R. T.

Dissolution potential. Aluminium in presence of different gases. (MLLE.) N. GOLDOWSKI (Compt. rend., 1939, **208**, 1086—1088).—The influence of the composition and the R.H. of the surrounding gas on the dissolution potential (V) has been investigated for pure Al. An Al cylinder, cleaned in the appropriate gas (air, SO_2, and dry and damp O_2, H_2, CO_2), was left in contact with the gas for ~10 min. before being dipped in the electrolyte (1% NaCl) at 30°. The p.d. between the Al and a calomel electrode was then measured over a period of 12—24 hr. The data indicate that the metal surface undergoes two alterations : (i) the Al adsorbs the gas as a surface layer, and (ii) the electrolyte acts on the surface layer with a consequent change in V.   W. R. A.

Chromate–chromic electrode potential. S. A. DURBAN and D. J. BROWN (J. Physical Chem., 1939, **43**, 491—493).—Measurements on the $Cr(ClO_4)_3$, CrO_3, $HClO_4$|Pt half-cell indicate that the reversible oxidation potential at 25° is $1 \cdot 195 \pm 0 \cdot 010$ v. The reaction in the half-cell is $HCrO_4' + 7H^{\cdot} + 3e \rightleftharpoons Cr^{\cdots} + 4H_2O$.   J. W. S.

Oxidation–reduction potential of iodine. II. Influence of dissolved substances on the redox potential of iodine. A. I. RUSANOVA (J. Gen. Chem. Russ., 1938, **8**, 1286—1295).—The potential of I in KI increases with rising [NaCl] up to 2N., above which it falls; NaBr has the reverse effect. The [I] can be determined from the redox potential of its solutions in aq. KI. The potential is unaffected by varying the p_H from 2·9 to 9.   R. T.

Introduction of extraneous solutes into aqueous potassium iodide solution, and its electrostatic consequences. (MLLE.) S. VEIL (Compt. rend., 1939, **208**, 1306—1307).—The e.m.f. of the cell Ag|KI (satd.)|Pt (0·73 v.) is reduced by saturation of the KI solution with HgI_2 (0·10) or AgI (0·57 v.), but is scarcely affected by adding PbI_2 (0·74 v.). This shows that PbI_2 has the least perturbing influence on the structure of the KI solution ; the large reduction with HgI_2 is due to formation of HgI_4''.   A. J. E. W.

Influence of CN′ concentration on the deposition potential of $Ni^{\cdot\cdot}$ at a dropping mercury electrode, and on the height of the diffusion wave of the latter. J. P. GOCHSCHTEIN and V. A. POKROVSKI (J. Gen. Chem. Russ., 1939, **8**, 1465— 1469).—The potential of a Hg anode in aq. $NiCl_2$ changes from positive to negative as the [KCN] of the solution is raised from 0·02 to 0·1N. The height of the $Ni^{\cdot\cdot}$ polarographic wave is const. only in presence of excess of KCN, in which case it varies according to the length of time the solution is exposed to the air.   R. T.

Polarisation e.m.f. in electrolysis of fused carnallite. I. G. Schtscherbakov, A. A. Schtscherbakov, and B. F. Markov (J. Appl. Chem. Russ., 1938, **11**, 1584—1588).—The polarisation potential of fused carnallite rises slightly with increasing c.d., and considerably with diminishing [$MgCl_2$]. The results for the system $MgCl_2$–KCl do not differ from those for carnallite.   R. T.

Polarisation of galvanic cells. E. Toporescu (Compt. rend., 1939, **208**, 1004—1005).—Hg from the cell Hg|conc. aq. $ZnSO_4$|Zn, after slow polarisation, contains Zn, to which the polarisation phenomena are due.   A. J. E. W.

Polarisation of the electrolytic liberation of oxygen from nickel–iron and nickel–cobalt alloys in alkaline solution. G. Grube and W. Gaupp (Z. Elektrochem., 1939, **45**, 290—296).—The variations of anode potential, E, of rolled and annealed Ni–Fe and Ni–Co alloys in 7N-KOH at 60° for c.d. 0·0005—0·075 amp. per sq. cm. have been determined, together with the variations over a week of E of the rolled alloys at 0·025 and 0·05 amp. per sq. cm., respectively. E increases with c.d. and is greater for annealed than for rolled alloys. For Ni–Co alloys containing $< \sim 70\%$ of Co, E remains const. for a given c.d., but with increase in Co content E diminishes. For Ni–Fe alloys, E is $\sim$ const. between 30% and 70% of Fe. Below 30% and above 70%, E is respectively $<$ and $>$ the const. val. E increases with time for rolled Ni–Co and Ni–Fe alloys, but if the % of Ni in the latter is small the increase rapidly becomes a decrease.   C. R. H.

Depolarisation potentials of phenyl alkyl ketones in acid, neutral, and basic media at the dropping mercury cathode. W. C. Davies and D. P. Evans (J.C.S., 1939, 546—554).—The depolarisation potentials (V) of the ketones $COPhR$ (R = Me, Et, Pr^α, Pr^β, or Bu^α) have been measured by Heyrovský's method using solutions in EtOH–H_2O mixtures containing LiCl, LiOH, or LiCl + HCl. The polarograms indicate that V is less negative in acid than in neutral or alkaline solutions. V varies irregularly in acid solution, but in alkaline solution it attains higher negative vals. with increasing length of the n-alkyl chain, whilst the sec. alkyl in $COPhPr^\beta$ has a still larger effect. The variations of the heights of the waves given by COPhMe in alkaline solution and by H· and COPhMe in acid solution have been studied for various [COPhMe]. The results are discussed with reference to possible mechanisms of the reduction of the ketones.   J. W. S.

Fundamental studies with the dropping mercury electrode. I. Ilkovič equation of polarographic diffusion currents. J. J. Lingane and I. M. Kolthoff (J. Amer. Chem. Soc., 1939, **61**, 825—834).—Using the dropping Hg electrode, the diffusion current consts., K, of Tl·, Pb··, Cd··, Zn··, IO_3', and $Fe(CN)_6'''$ have been determined in 0·1N-KCl solution at 25°. For the metal ions the diffusion current is $\propto$ the concns. of ions in the range 10^{-4} to 10^{-2}M., whilst for IO_3' and $Fe(CN)_6'''$ ions this proportionality holds for 2×10^{-4} to 10^{-3}M., and 2×10^{-4} to 5×10^{-3}M., respectively. K for Tl·, Pb··, and IO_3'

agrees with the vals. obtained from the Ilkovič equation (A., 1935, 305); for Zn·· and Cd·· K is $>$ calc. vals. by 5 and 8%, respectively, due possibly to the existence of a considerable fraction of CdCl· and ZnCl· ions in the presence of excess of Cl' ions, and K for $Fe(CN)_6'''$ is 8% $<$ the calc. val. due possibly to some chemical interaction between the ions and the Hg which would decrease the no. of $Fe(CN)_6'''$ ions available for electro-reduction and hence decrease K. The Ilkovič equation appears to be essentially correct.   W. R. A.

Polarographic current–voltage curves with dropping amalgam electrodes. J. J. Lingane (J. Amer. Chem. Soc., 1939, **61**, 976—977).—Using the polarographic technique with dropping amalgam electrodes, anodic current–voltage curves can be obtained with characteristics similar to those obtained with the dropping Hg electrode. This is illustrated with reference to data obtained with an approx. 0·01% Cd amalgam dropping into an air-free 0·1N-KCl solution containing 0·04M-$CdSO_4$. The anodic section of the curve shows a prominent max. similar to that obtained with the reduction of metal ions at the dropping Hg electrode, which is followed by a diffusion current $\propto$ amalgam concn. Addition of Me-red eliminates the anodic max. and gives a well-defined wave with a const. diffusion current. This effect of Me-red (as for the common cathodic max.) is caused by phenomena on the solution side of the amalgam–solution interface.   W. R. A.

Effect of alternating current on the element Pb|H_2SO_4|Pt. J. Kamecki and M. Wierzbicki (Rocz. Chem., 1939, **19**, 249—258).—The strength of the current arising in the cell Pb|aq. H_2SO_4|Pt rises, whilst time elapsing before discharge of the cell falls, as the [H_2SO_4] is raised from 0·2 to 5N. During and after passage of an a.c. (c.d. 0·5—2 amp. at 1—5·3 v.) a d.c. arises; this is due to de-passivation of the Pb, by removal of the $PbSO_4$ coating, in the case of 0·2—0·5N-H_2SO_4, and to a rectifying effect in that of 5N-H_2SO_4.   R. T.

Chemical kinetics. R. Piontelli (Chim. e l'Ind., 1939, **21**, 131—139).—A lecture, summarising modern theories of uni- and bi-mol., catalytic and chain reactions.   O. J. W.

Solution of an equation occurring in the theory of consecutive reactions. A. L. Selikowitz (J. Chem. Physics, 1939, **7**, 278).   W. R. A.

Explosion limits of the hydrogen–oxygen mixture. O. Oldenberg and H. S. Sommers, jun. (J. Chem. Physics, 1939, **7**, 279).—Above the " upper " explosion limit in the reaction between H_2 and O_2 is a " third " limit (I). The reaction has been investigated at pressures between 47 and 77 cm. and between 540° and 575°, using Pyrex vessels coated with KCl to slow down the reaction. Several hundred experiments have been made and not one vessel has been shattered. (I) has an inhibition period; at a given temp. explosion will occur in a certain pressure range and the higher is the pressure the shorter is the inhibition period. In clean Pyrex (I) takes place at lower temp. than with KCl-coated Pyrex and (1) occurs at lower pressures in vessels of large diameter. The

theory of (I), proposed by Lewis and von Elbe, approx. accounts for the experimental phenomena.

W. R. A.

Methods for determining rate of chemical reactions in the gas phase. C. G. SILCOCKS and M. W. TRAVERS (Trans. Faraday Soc., 1939, **35**, 656—665).—Experimental technique is described, with special reference to (1) heating a known mass of gas or vapour without material time or temp. lag in starting or stopping the process, and (2) analysing the contents of the reaction vessel. F. L. U.

Reaction between nitric oxide and nitrogenous free radicals. C. H. BAMFORD (Trans. Faraday Soc., 1939, **35**, 568—576; cf. A., 1939, II, 100).—In the reaction between NO and NH_3 illuminated with a Hg arc N_2 is produced in nearly quant. yield. NO with N_2H_4 vapour under the same conditions gives N_2O and NH_3. The results are explained by the reaction of NO with the free radicals produced by photolysis thus : $NH_2 + NO = N_2 + H_2O + 104$ kg.-cal.; $N_2H_3 + NO = N_2O + NH_3 + 75$ kg.-cal.

F. L. U.

Kinetics of hydrocarbon decomposition. M. W. TRAVERS (J. Amer. Chem. Soc., 1939, **61**, 977).—A reply to the criticism of Steacie (cf. Chem. Rev., 1938, **22**, 311). W. R. A.

Kinetics of oxidation of methane. I. Intermediate products. W. STARONKA and L. CZERSKI (Rocz. Chem., 1939, **19**, 259—276).—2·2 : 1 and 1 : 1 CH_4-O_2 mixtures were heated at 460—483°. The yield of CH_2O is max. (0·5—0·8 ml. per 100 ml. of gas mixture) after 0·5—1 min., varying little thereafter. That of MeOH is max. (0·7—1·4 ml.) after 0·8—1·8 min., thereafter falling more or less abruptly. The highest yields of MeOH are obtained by low-temp. oxidation of CH_4-rich mixtures. CH_2O is not initially produced by oxidation of MeOH. The results support the view that oxidation of CH_4 in absence of contact substances is a chain reaction, preponderatingly homogeneous, although stoicheiometrically heterogeneous. R. T.

Thermal decomposition of ethane by addition of foreign gases. L. KÜCHLER and H. THIELE (Z. physikal. Chem., 1939, **42**, B, 359—379).—The thermal decomp. of C_2H_6 under various experimental conditions, and with addition of foreign gases (He, A, H_2, N_2, CO, CO_2, CH_4), has been investigated by following the val. of the unimol. velocity coeff. with pressure. C_2H_6 decomposes partly by radical chains and partly by a chain-free mechanism. The activation energy of the total decomp. is 76·4 kg.-cal.; that of the chain-free decomp. is 77·0 kg.-cal. A scheme of decomp. of C_2H_6 in which the initial stage is formation of 2 CH_3 radicals is discussed.

W. R. A.

Theory of absolute reaction rates and the polymerisation of ethylene. F. P. JAHN (J. Amer. Chem. Soc., 1939, **61**, 798—800).—The rate of polymerisation of C_2H_4 at 250—400° is interpreted according to the theory of Wynne-Jones and Eyring (A., 1935, 1205). R. S. C.

Detonation of mixtures of pentane and hexane with air in tubes. K. I. SCHTSCHOLKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 111—112).—The behaviour of a mixture of 45% C_5H_{12} and 55% C_6H_{14} with air has been investigated at initial pressures of 1—10 kg. per sq. cm. and 20—500° in a rapid automatic apparatus devised to carry out the test during the interval preceding spontaneous combustion.

F. R. G.

Pyrogenic reactions of condensation of hydrocarbons. VI. Thermo-polymerisation of *cyclo*hexene. VII. Thermo-polymerisation of *n*-octene. M. S. NEMTZOV, T. V. NIZOVKINA, and E. A. SOSKINA (J. Gen. Chem. Russ., 1938, **8**, 1303—1313, 1314—1325).—VI. The chief product obtained by heating *cyclo*hexene at <430° is *cyclo*hexyl-Δ^1-*cyclo*hexene. The reaction velocity is not altered in presence of Fe or small amounts of O_2, but is greatly increased by P_2O_5. The reaction is of the second order. Its velocity is expressed by log $k = 12·18 - 10,250/T$, with an activation energy $E = 47,000 \pm 2000$ g.-cal.

VII. A mixture of Δ^a- and Δ^β-octene similarly yields chiefly a dimeride, of undetermined structure. The reaction velocity is log $k = 10·54 - 8900/T$ ($E = 40,500 \pm 2000$ g.-cal.). The by-products are *iso*-hydrocarbons, C_{12} compounds, and higher polymerides, but not cyclic compounds. R. T.

Mechanism of reactions between alkali metal atoms and methyl and phenyl halides. M. G. EVANS and E. WARHURST (Trans. Faraday Soc., 1939, **35**, 593—606; cf. A., 1938, I, 145).—The method of potential energy surfaces is used to calculate the activation energies of reactions $Na + RX = NaX + R$. Comparison of calc. with experimental vals. for the Me halides indicates that the simplified method used is justified. Similar treatment of the Ph halides gives vals. of the right order, but more subject to uncertainty arising from lack of precision in the data.

F. L. U.

Kinetics of the thermal decomposition of the methylamines. A. G. CARTER, P. A. BOSANQUET, C. G. SILCOCKS, M. W. TRAVERS, and A. F. WILSHIRE (J.C.S., 1939, 495—506).—The decomp. of NMe_3 at 380—440° yields CH_4 and CH_2:NMe, with a little H_2 and C_2H_6. The curves of formation of CH_4 are of unimol. type, and the Arrhenius equation is obeyed, E being ~59 kg.-cal. The rate of formation of CH_4 is diminished by packing the tube and increased by addition of He. The following chain mechanism is proposed : $NMe_3 = Me\cdot + NMe_2\cdot$; $NMe_3 + Me\cdot = CH_4 + \cdot CH_2\cdot NMe_2$; $\cdot CH_2\cdot NMe_2 = Me\cdot = CH_2$:NMe. The rate of production of C_2H_6 increases with time in the earlier stages and appears to be zero at zero time. It is a secondary process, probably not the direct union of 2 Me·, but involving Me· together with some other intermediate substance. The decomp. of $NHMe_2$ at 420—440° yields CH_4, CH_2:NMe, NH_2Me, and a little H_2. The rate of formation of CH_4 and its temp. coeff. ($E \sim 56$ kg.-cal.) are ~ those in the decomp. of NMe_3, and the formation of CH_4 is much retarded by packing the tube. The process is more complex than the decomp. of NMe_3, but probably involves a similar chain mechanism. The rate of decomp. of NH_2Me becomes comparable with those of the other two amines only at

temp. 100° higher, and E is considerably less, probably ~45 kg.-cal. The reaction is very complex, and surface effects are marked. It probably involves three successive stages, H_2 being a product of the first, CH_4 of the second, and HCN of the third. The resemblances between NMe_3 and $NHMe_2$ on the one hand, and NH_2Me and NH_3 on the other, are noteworthy.　　　　F. J. G.

Mechanism of oxidation of organic compounds with selenium dioxide. IV. Kinetics of oxidation of ketones. N. N. MELNIKOV and M. S. ROKITSKAJA (J. Gen. Chem. Russ., 1938, **8**, 1369—1381).—The velocity of oxidation of ketones by SeO_2 rises with increasing enolisation of the ketones, and falls with increasing mol. wt.; for the same mol. wt. it is greater for *n*- than for branched-chain radicals, and greater for cyclic than for other ketones. In the series 1 : 2-, 1 : 3-, and 1 : 4-dimethyl*cyclo*hexanone the velocity rises in the order given.　　　　R. T.

Application of constant sulphite solution to the study of the reaction between sulphurous acid and iodic acid. A. HENDERSON and W. P. McCULLOCH (J.C.S., 1939, 675—676).—When the wts. of SO_3'' and HIO_3 are const., and the total wt. of solution (K) is varied, the time of reaction (t) is given by $t/K^2 = aK^2 + bK + c$, a, b, and c being consts.　　　　F. J. G.

Reactions in concentrated sulphuric acid. XIV. Decomposition of acetylene, especially at higher temperatures. J. MILBAUER and L. FRITSCH (Chem. Obzor, 1939, **14**, 1—5, 25—30).—Decomp. of C_2H_2 in conc. H_2SO_4 at 100—300° has been studied photocolorimetrically and by measuring the SO_2 liberated. The following reactions take place at room temp.: $nC_2H_2 \rightarrow C_{2n}H_{2n}$; $C_{2n}H_{2n} \rightarrow CH:C\cdot C:C\cdot$ . . . $\cdot C:CH + H_{2n-2}$; $2C_{2n}H_2 \rightarrow nC_4 + 2H_2$; $2C_2H_2 \rightarrow C_4 + 2H_2$. At higher temp. the reactions are: $C_4 + 4H_2SO_4 \rightarrow 4CO + 4SO_2 + 4H_2O$; $CO + H_2SO_4 \rightarrow CO_2 + H_2O + SO_2$; $H_2 + H_2SO_4 \rightarrow 2H_2O + SO_2$. The relative effects on the absorption and velocity of decomp. at higher temp. of C_2H_2 in H_2SO_4, for which $HgSO_4$ is the most effective and $(NH_4)_2SO_4$ is a definite negative catalyst, of the reagents $HgSO_4$, SeO_2, Ag_2SO_4, TeO_2, V_2O_5, MoO_3, $CuSO_4$, $Sn(SO_4)_2$, $(NH_4)_2SO_4$, and alkali sulphates are discussed in detail.　　　　F. R.

Kinetics of esterification of normal fatty acids. R. A. FAIRCLOUGH and C. N. HINSHELWOOD (J.C.S., 1939, 593—600).—Experiments with a mechanical model, in which steel balls represent mols., suggest that increasing incompatibility of packing with the solvent mols. might lead to an increase of the no. of collisions between solute mols. Accordingly this effect has been sought in the esterification of long-chain fatty acids, which, in solution in the alcohol and with the undissociated acid as its own catalyst, is bimol. with respect to the acid. In EtOH, for a no. of normal acids (from C_2 to C_{22}), E is approx. const. (14,800—15,200 g.-cal.), whilst k decreases from C_2 to C_4, then increases with increasing chain-length. In *cyclo*hexanol E decreases from 16,600 g.-cal. for C_2 to approx. 15,000 g.-cal. for C_4 and higher acids, whilst k shows a similar but smaller increase. On the other hand, in the H-catalysed reaction in MeOH

E decreases from 12,450 for C_2 to 11,600 for C_3, and then remains approx. const., k also remaining approx. const. for acids with >3 C. The increase of k for the higher acids when the catalyst is the undissociated acid may therefore be attributed to the increase of Z as predicted from the model.　　　　F. J. G.

Kinetics of alkaline hydrolysis of some γ-lactones. D. S. HEGAN and J. H. WOLFENDEN (J.C.S., 1939, 508—510).—The rates of hydrolysis by NaOH of valerolactone and phthalide in H_2O and in $EtOH$–H_2O mixtures, and of 5-aminophthalide and butyrolactone in H_2O, have been determined at a no. of temp. The vals. for E range from 10,800 to 16,100 g.-cal., and those for $\log PZ$ from 7·46 to 10·54. The plot of $1\sqrt{E}$ against $\log PZ$ for all of the reactions is a single straight line, the slope of which is ~ those found by Fairclough and Hinshelwood (A., 1937, I, 313) for the alkaline hydrolysis of MeOAc and MeOBz in mixed solvents. The work of Tasman (A., 1927, 1186) is criticised.　　　　F. J. G.

Hydrolysis of triphenylmethyl chloride in dioxan.—See A., 1939, II, 211.

Entropies and energies of activation of ionic reactions. Kinetics of the alkaline fading of bromophenol-blue in isodielectric media. E. S. AMIS and V. K. LA MER (J. Amer. Chem. Soc., 1939, **61**, 905—913).—The kinetics of fading of bromophenol-blue in H_2O, MeOH, and EtOH solutions containing 0·003—0·09N-NaOH at 5°, 25°, and 45° have been investigated. The mechanism of the reaction and factors (*e.g.*, temp., ionic strength, dielectric const.) influencing the entropy and energy of activation are discussed.　　　　W. R. A.

Ether-like compounds. XXIII. Saponification of the trichloroacetic esters. H. H. PALOMAA, E. J. SALMI, and R. KORTE (Ber., 1939, **72**, [*B*], 790—797).—The rates of hydrolysis of a no. of esters, $CCl_3\cdot CO_2R$, and, for comparison, of the acid hydrolysis of the Me and Et esters of $EtCO_2H$ and of Pr^aCO_2H, in H_2O and in aq. dioxan, have been studied. The former reactions, which are not catalysed by acid, are much retarded by dioxan, whilst the latter are slightly accelerated by dioxan. The temp. coeffs. for 10° in the former reactions are ~1·7, in agreement with vals. found for alkaline hydrolysis and in contrast with the vals. (2·3 for ester-like and 4 for ether-like hydrolysis) found in acid-catalysed reactions. A further resemblance between the aq. saponification of the esters $CCl_3\cdot CO_2R$ and alkaline saponification is seen in the influence of the alkyl radicals, the rate decreasing markedly in the order R = Me, Et, Pr^a, Bu^a. The following have been prepared: $CCl_3\cdot CO_2Bu^a$, b.p. 102—103°/17 mm., $CCl_3\cdot CO_2\cdot[CH_2]_3\cdot OMe$, b.p. 104—104·5°/10 mm., $CCl_3\cdot CO_2\cdot[CH_2]_4\cdot OMe$, b.p. 109·5—110°/6 mm., $CCl_3\cdot CO_2\cdot[CH_2]_2\cdot Br$, b.p. 97·0—97·7°/5 mm., $CCl_3\cdot CO_2\cdot[CH_2]_3\cdot Cl$, b.p. 97·0—97·7°/3 mm.　　　　F. J. G.

Absolute values of the velocity constants in the formation of semiquinone. G. KORNFELD (J. Chem. Physics, 1939, **7**, 274—276).—From the mechanism proposed previously (A., 1939, II, 153) for the autoxidation of quinol and its homologues a

lower limit can be calc. for the abs. val. of the velocity coeff. of the formation of semiquinone ions from quinone and doubly-charged quinol ions. W. R. A.

Reducing action of ascorbic acid on mercuric chloride. R. INDOVINA and F. MANFROI (Gazzetta, 1939, 69, 117—121).—The reaction $2HgCl_2 + C_6H_8O_6 = C_6H_6O_6 + Hg_2Cl_2 + 2HCl$ takes place quantitatively and kinetic measurements show that it is of the third order. O. J. W.

Velocity of dissolution of comminuted substances. X. Dissolution of tartaric acid and sugar in water. W. JACEK (Rocz. Chem., 1939, 19, 243—248).—The velocity of dissolution of tartaric acid and sucrose in H_2O at 17·5—21° has been determined. R. T.

Active oxides and reactions of solids. CXV. Velocity of dissolution of alumina, in relation to its previous treatment. G. F. HÜTTIG, G. MARKUS, and E. FRANZ [with O. HNEVKOVSKY] (Przemyśl Chem., 1938, 22, 375—380).—The velocity of dissolution of Al_2O_3 in HCl falls as the temp. at which it had been heated rises (850—1100°). The debyeograms correspond with γ-Al_2O_3 at 850°, and with admixture of α-Al_2O_3 at 950°, whilst after 6 hr. at 1000° or 1 hr. at 1100° only α-Al_2O_3 is found. The velocity of dissolution curves, with varying proportions of Al_2O_3 to acid, are consistent with the view that the oxides consist chiefly of sparingly sol., with an admixture of readily sol., forms. R. T.

Velocity of dissolution of aluminium in sodium hydroxide solution.—See B., 1939, 506.

Oxidation of beryllium and of nickel at high temperatures. H. N. TEREM (Bull. Soc. chim., 1939, [v], 6, 664—672).—The oxidation of Ni powder at 850—1050° follows the equation of Valensi (A., 1936, 434) with an energy of activation 55,260 g.-cal. With Be powder under the same conditions S-shaped curves of autocatalytic type are obtained, the later parts of which can be fitted to an equation of the Valensi form, giving an energy of activation 41,446 g.-cal. F. J. G.

Interchange reaction of the oxygen atom between inorganic anions and water. T. TITANI and K. GOTO (Bull. Chem. Soc. Japan, 1939, 14, 77—85).—Measurements with H_2O containing ^{18}O and K_2SO_4, KNO_3, $NaClO_3$, K_2CO_3, KH_2AsO_4, KH_2PO_4, and $KHSO_4$ show that the O interchange reaction is catalysed both by H˙ and OH′. The mechanism of the reaction resembles that of the saponification of esters (A., 1938, I, 251, 635). In acid solution and at high temp. the intermediate formation of the anhydride mol. is suggested. D. F. R.

Acid–base catalysis in gas reactions. II. Decomposition of various organic compounds. R. P. BELL and R. LE G. BURNETT (Trans. Faraday Soc., 1939, 35, 474—481; cf. A., 1937, I, 250).—The rate of decomp. of $CHMe(OAc)_2$ and of diacetone alcohol (I) is not catalysed by HBr, the decomp. of (I) being also unaffected by NH_3 and piperidine. The thermal decomp. of dioxan and of MeCHO and the depolymerisation of trioxymethylene (II) are accelerated by HCl and HBr. The rate of depoly-

merisation of (II) in decalin solution, catalysed by HBr, is of the first order with respect to both (II) and HBr, and has a steric factor of $\sim 10^{-10}$. The effect of surfaces and non-ionising solvents on acid–base catalysis, and the relative catalytic effects of HCl and HBr, are discussed theoretically. J. W. S.

Kinetics and mechanism of redox reactions. III. Kinetics of oxidation of Fe^{II} by chlorate. V. F. STEFANOVSKI and A. M. ZANKO (J. Gen. Chem. Russ., 1938, 8, 1717—1726).—With high $[H_2SO_4]$ the velocity of oxidation of Fe^{II} by ClO_3' $\propto [ClO_3']$ and [Fe˙˙]; the temp. coeff. is 2·73. In presence of OsO_4 catalyst the velocity of the reaction is expressed by $K[Fe˙˙]^2[H_2SO_4][OsO_4]^b/[Fe˙˙˙]^a$, and in presence of Fe^{III} by $K[Fe˙˙]^2[H_2SO_4]$. R. T.

Effect of porphyrin, cholate, phosphate, and citrate on the autoxidation of linoleic acid in buffer solution. K. HINSBERG and G. LAHN (Biochem. Z., 1939, 300, 301—312; cf. A., 1937, II, 175). —In presence of PO_4''' buffer and Na cholate hæmatoporphyrin (I) inhibits the autoxidation of linoleic acid. The effect is counteracted by C_5H_5N, which, alone, has a slight inhibitory effect. EtOH alone has no inhibitory effect but, in very small amounts, it accelerates the onset of inhibition by (I). When citrate replaces PO_4''' as buffer (I) acts more slowly and C_5H_5N alone stimulates the autoxidation. In the absence of cholate the effect of (I) is less and the max. is sooner attained. When no buffer is present the autoxidation is not affected by (I) or by C_5H_5N but is stimulated when both are added together and is very greatly accelerated by EtOH. In presence of PO_4''' and cholate the autoxidation is scarcely affected by hæmin or by C_5H_5N but is inhibited by C_5H_5N + hæmin. C_5H_5N + hæmin has less effect when cholate is absent and very little effect when buffer is also absent. When citrate replaces PO_4''' as buffer and cholate is present, inhibition of the autoxidation by hæmin is increased by adding C_5H_5N; in the absence of cholate the effects are less pronounced. Possibly C_5H_5N and (I) yield a complex having catalytic properties different from those of (I). The oxidation-reduction potential of hæmin is altered when it is converted into hæmin–C_5H_5N complex. W. McC.

Autoxidation of linoleic acid in presence of porphyrins. K. HINSBERG and H. NOWAKOWSKI (Biochem. Z., 1939, 300, 313—324).—During the autoxidation, in presence of Na cholate, the total O_2 uptake is greater in PO_4''' than in citrate buffer but the accompanying fall in p_H is greater in citrate than in PO_4''' buffer and the period of induction is longer. The min. amounts of coproporphyrin-III, proto-, deutero-, and isouro-porphyrin which inhibit the autoxidation of 0·84 g. of the acid in PO_4''' buffer are $\sim 0·05$, 0·05, 0·14, 0·05 mg. the corresponding vals. in citrate buffer being $\sim 0·05$, 0·007, 0·04, and 0·05 mg. The total O_2 uptake is the same with all the porphyrins. When equal wts. of the porphyrins are used, the degree of inhibition, as measured by the length of the induction period, decreases in the order hæmato-, proto-, deutero-, copro-, and isouro-porphyrin. C_5H_5N counteracts the effect of the porphyrins. W. McC.

Organic catalysts. Synthetic carboxylases.—See A., 1939, II, 283.

Influence of ketones on the Cannizzaro–Tischtschenko reaction.—See A., 1939, II, 244.

Velocity of hydrogenation of isomeric olefines. S. P. LAGEREV and M. M. ABRAMOV (J. Gen. Chem. Russ., 1938, **8**, 1682—1684).—The velocity of hydrogenation (Pt-black catalyst) of $CHMe:CHPr^\alpha$, $CHMe:CHPr^\beta$, and $CMe_2:CMe_2$ falls in the order given.
R. T.

Copper–nickel catalyst for hydrogenation of fats.—See B., 1939, 512.

Correlation of adsorption and catalytic activity. I. Hydrogen adsorption on zinc–chromium catalysts. F. RUMFORD (J. Roy. Tech. Coll., 1939, **4**, 427—440).—The relation between adsorption and catalytic acitivity is discussed. Catalytic mixtures of ZnO and CrO_3 in different proportions are first reduced by heating in MeOH vapour and then their adsorption of H_2 is measured. The variation of catalytic acitivity and adsorption with temp. is also studied.
T. H. G.

Catalytic exchange of hydrogen. C. HORREX, R. K. GREENHALGH, and M. POLANYI (Trans. Faraday Soc., 1939, **35**, 511—520).—The interchange of H and D atoms between H_2 and H_2O, *cyclo*hexane (I), *iso*-C_5H_{12} (II), C_6H_6, and HCl on a Pt catalyst has been studied at 40—105°. C_6H_6 exchanges more rapidly with H_2 than do (I) and (II), but the exchanges with H_2O proceed at equal rates. This is attributed to the fact that C_6H_6 is attacked chemically by H_2 but not by H_2O. (I) and (II) exchange with H_2O more rapidly than with H_2 gas, but exchange with one another less rapidly. (I) also exchanges less rapidly with HCl. The conversion of *para*-H, and the exchanges between H_2 and H_2O or HCl in presence of hydrocarbons, proceed much more rapidly than the exchanges with the hydrocarbon mols.
J. W. S.

Catalytic exchange of deuterium and hydrogen in hydrocarbons. S. R. CRAXFORD, G. H. TWIGG, and E. K. RIDEAL (Nature, 1939, **143**, 472—473).—The primary act in the catalytic exchange between D_2 and olefines is the addition and not the loss of a H atom (cf. A., 1939, I, 270). With saturated hydrocarbons, catalytic exchange, degradation, and dehydrogenation all appear to involve H in the chemisorption process.
L. S. T.

Organic catalysts for removal of carbon monoxide from formamide.—See A., 1939, II, 249.

Genesis of skeleton [hydrogenation] catalysts.—See B., 1939, 513.

Retarding action of addition of hexamethylenetetramine [on dissolution of aluminium].—See B., 1939, 506.

Contact sulphuric acid manufacture. Chromium oxide catalyst.—See B., 1939, 478.

Synthesis of paraffins from carbon monoxide and hydrogen on cobalt catalysts.—See B., 1939, 462.

Copper–zinc–chromium methyl alcohol catalyst.—See B., 1939, 462.

Nickel, cadmium, and lead sulphides as catalysts in the vapour-phase reduction of nitrobenzene.—See B., 1939, 463.

Catalysts for hydrogenation of coal.—See B., 1939, 454.

Electrolytic formation of persulphate. V. With alternating current superimposed on direct current. R. MATSUDA and T. NISHIMORI (Bull. Chem. Soc. Japan, 1939, **14**, 72—77; cf. A., 1936, 436; 1937, I, 37, 525, 626).—In the electrolysis of $10N$-H_2SO_4 with 0·1 amp. a.c. superimposed, a greater d.c. current efficiency is obtained by using a diaphragm. The efficiency is increased by replacing the H_2SO_4 by small amounts of $K_2SO_4 > (NH_4)_2SO_4 > Na_2SO_4$; it is also increased by increasing $[SO_4]$ but to a smaller extent than with d.c. alone. Variation of the a.c. has little effect.
D. F. R.

Separation of the two phosphides of vanadium by electrolysis of fused mixtures. M. CHÊNE (Compt. rend., 1939, **208**, 1144—1146).—Using a melt of V_2O_5 in alkali phosphates (with suitable amounts of metal halides) as electrolyte, cryst. V phosphides are obtained but their separation from the phosphates is difficult. The best results are obtained with the following electrolytes : $HPO_3 + \frac{1}{15}V_2O_5 + MgCl_2 + 2LiCl$ at 800° (I), $HPO_3 + \frac{1}{15}V_2O_5 + 2MgCl_2 + LiCl$ at 850° (II), $Li_3PO_4 + \frac{1}{10}V_2O_5 + 2LiF$ at 900° (III), and $Li_3PO_4 + \frac{1}{15}V_2O_5 + LiF + MgF_2$ at 900° (IV). The melts are electrolysed in a C crucible (cathode) with a C anode, and the product yields the phosphides on treatment with warm dil. HCl (phosphides insol.). (I) and (II) yield PV whilst (III) and (IV) yield PV_2. Both form metallic needles, d^0 4·0 (PV) and 4·5 (PV_2). They are acid-resisting, but are decomposed by alkalis and alkali salts in the fused state.
W. R. A.

Electrolytic formation of bismuth peroxide. M. HAÏSSINSKY and A. SANIÉLÉVICI (J. Chim. phys., 1939, **36**, 54—61).—Anodic deposition of BiO_2 occurs on electrolysis of $Bi(NO_3)_3$ in aq. K_2 tartrate or in aq. HNO_3 using a Pt anode and a Pt or Au cathode. During electrolysis in tartrate solution the initial deposit redissolves and in aq. HNO_3 a period of induction generally elapses before deposition. The period of induction and speed of deposition $\propto$ c.d., acidity of solution, and $[Bi^{...}]$, the optimum conditions being : c.d. 2·5—3 ma. per sq. cm. using 1·5 mg. of $Bi(NO_3)_3$ per c.c. of 20% HNO_3, temp. ≯20°. BiO_2 is not formed in a primary electrolytic reaction but probably arises from the action of liberated O_3.
F. H.

Bright electrodeposition of cobalt.—See B., 1939, 507.

Anodic dissolution of alloys.—See B., 1939, 507.

Analogies between electrolytic and chemical methods of reduction. Experiments with sorbic acid.—See A., 1939, II, 241.

Electrochemical reduction of sugars.—See B., 1939, 537.

Electrolytic preparation of 5 : 7-di-iodo-8-quinolinol.—See B., 1939, 463.

Effect of X-rays on water. C. PIFFAULT (Compt. rend. Soc. Biol., 1939, **130**, 43—44).—H_2O_2, with simultaneous production of H_2, is formed in H_2O during intensive X-irradiation. H. G. R.

Decomposition of steam by X-rays. P. GÜNTHER and (FRL.) L. HOLZAPFEL (Z. physikal. Chem., 1939, **42**, **B**, 346—358).—A detailed account of work already noted (A., 1939, I, 88). W. R. A.

Source of cadmium resonance radiation of high intensity. Cadmium-photosensitised reaction of hydrogen and ethylene. E. W. R. STEACIE and R. POTVIN (Canad. J. Res., 1938, **16**, **B**, 337—340).—The Cd lamp described, similar in construction to a high-voltage Hg lamp, gives strong emission of the Cd 3261 A. line, whilst the 3404, 3466, and 3612 A. lines are relatively weaker and the 2288 A. line is entirely filtered out. In 3261 A. radiation and in the presence of Cd vapour, polymerisation of C_2H_4 occurs in C_2H_4–H_2 mixtures, but not in pure C_2H_4. In mixtures of high [C_2H_4] the rate of reaction is approx. $\propto$ the partial pressure of H_2. The mechanism of the activation of the C_2H_4 mols. is discussed. J. W. S.

Photo-oxidation of nitrite ion by bromine. A. E. CALLOW, R. O. GRIFFITH, and A. McKEOWN (Trans. Faraday Soc., 1939, **35**, 559—568; cf. A., 1939, I, 31).—The photochemical reaction between Br and NO_2' in presence of a large excess of Br' has been studied at 0° and 10° with $\lambda\lambda$ 436 and 365 mμ. The quantum yield is ~0·2 and nearly independent of experimental conditions, so that it probably represents the efficiency of photo-dissociation of Br_3'. The results suggest that the rate is determined entirely by the rate of primary production of Br atoms. The presence of traces of NO_2' reduces the quantum yield of the Br–oxalate photo-reaction nearly to the val. for the Br–NO_2' reaction. An explanation is offered. F. L. U.

Theory of the Schwarzschild effect. (A) KIENLE. (B) A. NARATH (Z. wiss. Phot., 1938, **37**, 282—283, 283; cf. Narath, A., 1938, I, 631).—Polemical. J. L.

Latent image formation at low temperatures. W. F. BERG (Trans. Faraday Soc., 1939, **35**, 445—458; cf. A., 1939, I, 89).—Measurements at 20°, 90°, and 293° K. indicate that changes in light absorption account for only a small fraction of the loss in sensitivity of photographic emulsions at low temp. The results support the view that ionic movements are essential to formation of the latent image (Gurney and Mott, A., 1938, I, 260). It is suggested that the low temp. causes trapping of electrons, mainly in the lattice but also to some extent in the sensitivity specks, and that these electrons recombine with Br atoms when the material becomes warm. J. W. S.

Photochemical changes in manganese glasses. —See B., 1939, 483.

Influence of nitric oxide on the photo-decomposition of methyl iodide. T. IREDALE (Trans. Faraday Soc., 1939, **35**, 458—463; cf. A., 1937, I, 370).—The quantum yield of I produced by irradiating MeI with a Hg-vapour lamp is increased greatly by the presence of NO. It is considered that the NO unites with the Me radical produced, forming MeNO, and thereby prevents the reproduction of MeI. A kinetic equation is derived to explain the results. J. W. S.

Photolysis of aldehydes and ketones in presence of iodine vapour. E. GORIN (J. Chem. Physics, 1939, **7**, 256—264).—The photolysis of $COMe_2$ takes place through a free radical mechanism involving primarily the splitting off of a Me radical. Using unfiltered Hg radiation the efficiency (η) is 1 and only a trace of CO is detected. With $\lambda = 3130$ A. η is slightly < 1 due to inactivation of excited $COMe_2$ mols. by collision. The following scheme for the chain photolysis of CH_2O is proposed in preference to that of Akeroyd and Norrish (cf. A., 1936, 1077) : $CH_2O + h\nu \rightarrow H + HCO$, $HCO \rightarrow H + CO$, $H + CH_2O \rightarrow H_2 + H + CO$, $H + HCO \rightarrow H_2 + CO$, and $H + H \rightarrow H_2$. In the photolysis of COMeEt, the primary reaction consists in the splitting off of a Me or Et radical. W. R. A.

Photolysis of acetyl bromide. D. H. ETZLER and G. K. ROLLEFSON (J. Amer. Chem. Soc., 1939, **61**, 800—806).—The photolysis of AcBr has been investigated at 2537 and 2652 A. No significant change in the efficiency (~0·5) at the two $\lambda\lambda$ has been observed. The products are CO, CH_4, Br_2, MeBr, and $C_2H_4Br_2$, and a pressure increase of 100% is observed. The photodecomp. therefore probably proceeds by way of a combination of $CH_3\cdot COBr \rightarrow CH_3Br + CO$ with $4CH_3\cdot COBr \rightarrow Br_2 + 4CO + 2CH_4 + C_2H_4Br_2$ or $4CH_3\cdot COBr \rightarrow 4CO + 2CH_2Br_2 + 2CH_4$. In presence of NO, the pressure increase is less and finally becomes a pressure decrease. This decrease is due to pptn. of RNO (R = Me, Ac, Br). W. R. A.

Photochemical decomposition of aromatic ketones : the phenyl radical.—See A., 1939, II, 266.

Photochemical bromination of trans-dichloroethylene and the bromine-sensitised photodecomposition of dichlorodibromoethane. K. L. MÜLLER and H. J. SCHUMACHER (Z. physikal. Chem., 1939, **42**, **B**, 327—345).—The photochemical formation and Br-sensitised decomp. of $(CHClBr)_2$ has been investigated, using light of λ 546 mμ., at different pressures and at temp. between 90° and 130°. The influences of [$(CHCl)_2$], [Br], light intensity, pressure, and temp. on the velocity of formation have been studied. Reaction mechanisms and quantum yields are given and activation energies of the reactions involved have been computed. The heat of reaction for the addition of Br to $(CHCl)_2$ is 17·3 kg.-cal., and the molar heat of vaporisation of $(CHClBr)_2$ is 11·1 kg.-cal. W. R. A.

Photochemical reaction between chlorine and trichlorobromomethane. H. J. SCHUMACHER (Z. physikal. Chem., 1939, **42**, **B**, 324—326).—An alternative mechanism to that proposed by Vesper and Rollefson (A., 1934, 976) is postulated. This mechanism does not involve Cl_3 formation and requires for CCl_4 formation : (i) $Cl_2 + h\nu = Cl + Cl$; (ii) $Cl + CCl_3Br = CCl_3 + BrCl$; (iii) $CCl_3 + Cl_2 = CCl_4 + Cl$. W. R. A.

Photochemical oxidation of trichlorobromomethane sensitised by bromine and by chlorine. W. FRANKE and H. J. SCHUMACHER (Z. physikal. Chem., 1939, **42**, **B**, 297—323).—The kinetics of the Br- and Cl_2-sensitised photo-oxidation of CCl_3Br at between 313 and 436 mμ. have been investigated in the gas phase. The relationship between the reaction velocity and $[CCl_3Br]$, the influences of light intensity, of [Br] or $[Cl_2]$, of $[O_2]$, of reaction products, and of total pressure, temp. coeffs., and quantum yields have been studied. Velocity equations and chain mechanisms are given for both reactions.   W. R. A.

Quantum efficiency of photosynthesis. F. R. RIEKE (J. Chem. Physics, 1939, **7**, 238—244).—Repetition of the experiments of Warburg and Negelein (cf. A., 1923, i, 718) on the photosynthesis in suspensions of unicellular green algæ yields a max. quantum efficiency of $1/4·22$ for the yellow Hg line in good agreement with their val. of $1/4·4$ for the same radiation.   W. R. A.

Hydrogen–bromine reaction under the influence of α-particles from radon. E. F. OGG (J. Physical Chem., 1939, **43**, 399—406).—The reaction between H_2 and Br under the influence of α-particles from Rn has been studied at 40—300° by determination of the increase of the HBr produced as compared with the pure thermal reaction. The average temp. coeff. at 40—192° of the reaction induced by α-particles is 1·07 per 10°. The apparent velocity of the reaction decreases at $> 200°$ owing to the decomp. of HBr formed thermally. The no. of HBr mols. formed per ion pair (M/N) is $\not> 2$, so it is inferred that reaction does not proceed by a clustering mechanism. For the decomp. of HBr by α-particles at $\sim 30°$, M/N is ~ 3. Evidence is obtained that during HBr synthesis at 35° $M/N \propto$ the amount of Rn decomposed   J. W. S.

Preparation of pure neon.—See B., 1939, 480.

Heavy water. G. KILDE (Dansk Tidsskr. Farm., 1939, **13**, 69—92).—A review of the chemistry of D.   M. H. M. A.

Separation of isotopes by fractional distillation of water.—See B., 1939, 449.

Preparation of sodium hexametaphosphate.—See B., 1939, 478.

Influence of cations in aqueous solution on the growth of crystals. T. YAMAMOTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 228—289).—Cations influence the growth of crystals of the alkali halides more than do anions in leading to the production of large transparent crystals instead of the small opaque crystals obtained from pure solutions. The influence of 36 cations on the form, growth rate, and transparency of crystals of Na, K, Rb, Cs, Li, and NH_4 chlorides, KBr, KI, K_2SO_4, and $KClO_3$ is discussed, photomicrographs being given. The extent of contamination of crystals by Cd, Pb, Bi, Mn, Cr, Co, and Ni is determined. Cations which exert a catalytic effect on crystal growth stabilise supersaturated solutions of such crystals. The methods of growth and their influence on the appearance of crystals are discussed.   F. H.

Preparation and concentration of radioactive gold. V. MAJER (Chem. Listy, 1939, **33**, 130—132).—$Na_3[Au(S_2O_3)_2]$ is bombarded with thermal neutrons from a Rn + Be source, to yield [198]Au. The product is shaken with Hg, which preferentially absorbs [198]Au (8-fold concn.). Alternatively, alkaline aq. $NaAuO_2$ is activated as above, when [198]Au is conc. on the ppt. forming.   R. T.

Neutral and basic beryllium carbonates. G. VENTURELLO (Gazzetta, 1939, **69**, 73—86).—A thermal and X-ray study of various basic Be carbonate preps. shows that these substances have not a definite composition. $BeCO_3,4H_2O$ has a hexagonal structure with a 5·12, c 15·77 A.   O. J. W.

Reactions in the solid state at high temperatures. XXII. Intermediate states which occur in the formation of magnesium titanate from magnesium oxide and titanium dioxide in the solid state. W. JANDER and G. LEUTHNER (Z. anorg. Chem., 1939, **241**, 57—75).—Mixtures of MgO and TiO_2 (rutile modification) were heated to various temp., and the products studied by means of X-rays, and with respect to their rate of dissolution in various reagents, catalytic activity for the combustion of CO and the decomp. of N_2O, and sorptive power for H_2O vapour and for dissolved dyes. For temp. of ignition increasing up to 400° the sorptive power decreases and the catalytic activity and rate of dissolution increase slightly. Thereafter the sorptive power, catalytic activity, and rate of dissolution all increase rapidly with rising temp. of ignition to a max. for products heated at approx. 550°, and then decrease again to a min. at ignition temp. of 700—800°, the sorptive and catalytic powers showing a further max. for products heated at approx. 950°. The combination of MgO and TiO_2 is very slow; it becomes chemically detectable in 6 hr. at 700°. The first X-ray lines of $MgTiO_3$ appear at 800°, but combination is still incomplete after 6 hr. at 1200°. The intermediate stage at 550° corresponds with penetration of the TiO_2 surface by individual MgO mols., giving a disrupted and highly active surface, which on further heating becomes consolidated by incipient combination. The second max. of surface activity for ignition temp. of approx. 950° may represent a similar disruption of the newly-formed $MgTiO_3$ surface by penetration of MgO or TiO_2 mols. (present in excess as combination is not complete), this being a first stage in the formation of Mg_2TiO_4 or of $MgTi_2O_5$, or it may, since combination is so slow, merely represent the increase in amount of freshly-formed, and so highly active, $MgTiO_3$ surface.   F. J. G.

Reaction of zinc salts with alkalis. A. I. NIKURASCHIN (J. Gen. Chem. Russ., 1938, **8**, 1454—1464).—Potentiometric study showed that the reactions taking place during progressive addition of alkali are : $ZnCl_2$ or $ZnSO_4 \rightarrow ZnCl_2,3Zn(OH)_2$ or $ZnSO_4,3Zn(OH)_2 \rightarrow Zn(OH)_2$. The curves for direct and back titration do not coincide, owing to the slowness of the reaction $ZnSO_4,3Zn(OH)_2 + 2OH' \rightarrow 4Zn(OH)_2 + SO_4''$. When $ZnCl_2$ is added to conc. NaOH, the first product is Na_2ZnO_2, which with further $ZnCl_2$ gives $Zn(OH)_2$, and this reacts with Na_2ZnO_2 to yield insol. $NaHZnO_2$.   R. T.

Alunite. VI. Y. ASADA (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 1300—1368).—The thermal decomp. of $K_2SO_4,Al_2(SO_4)_3,24H_2O$ and of $Al_2(SO_4)_3$ has been investigated. A. J. M.

Precipitation of hydroxides and related phenomena. T. KATSURAI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 191—227).—The progress of hydrolysis of $AlCl_3$, $MnCl_2$, $NiCl_2$, $CoCl_2$, $CrCl_3$, and $Pb(NO_3)_2$ at temp. $>100°$ during autoclaving was followed nephelometrically, an expression relating concn. of colloid with turbidity being deduced. X-Ray analyses of the product of hydrolysis obtained on heating aq. $FeCl_3$ at 120—180° and of $Fe(OH)_3$ dehydrated by ageing or by heating at 100° show the structures to be identical with that of hæmatite. Hydrolysis of $FeCl_3$, $AlCl_3$, and $CrCl_3$ is retarded by $NaCl$ or $BaCl_2$. Nephelometric and photometric studies during the addition of aq. NH_3 to aq. $FeCl_3$ show that for λ 6150 A. the light absorption follows the Lambert–Beer law with respect to $[NH_3]$ up to a max. turbidity. The different properties of the hydroxide pptd. from a mixture of $Fe^{..}$ and $Fe^{...}$ according to the method of prep. are described. A hydrosol of Fe_3O_4 is prepared by means of ultrasonic waves. Autoclaving of gels is used to prepare artificially the minerals northupite ($MgCO_3,Na_2CO_3,NaCl$) and tychite ($2MgCO_3,2Na_2CO_3,Na_2SO_4$). The decomp. of solutions of $K_3Fe(CN)_6$ and $K_4Fe(CN)_6$ and the coagulation of $Fe(CN)_6''''$, Ag halide, and As_2S_3 sols above 100° have been studied. Solid salts which on grinding together give gels are tabulated and their properties discussed. F. H.

Light of combustion of metals and alloys. II. J. A. M. VAN LIEMPT and J. A. DE VRIEND (Rec. trav. chim., 1939, **58**, 423—432).—Previous work (cf. A., 1937, I, 195) has been extended to the examination of Th, Ti, Al–Zr, Al–Mg–Zr, Al–Ti, Al–Ca, and Al–Li. The system of expressing light intensity is discussed and compared with the German system. C. R. H.

Ammoniates of gallium and indium trifluorides. W. KLEMM and H. KILIAN (Z. anorg. Chem., 1939, **241**, 93—96).—By extraction of $GaF_3,3H_2O$ and $InF_3,3H_2O$ with liquid NH_3, the *triammoniates* $GaF_3,3NH_3$ and $InF_3,3NH_3$ have been obtained. They take up no further NH_3 at $-78°$, but their dissociation isothermals indicate the existence of *diammoniates*. F. J. G.

Dimethylphosphates of the rare-earth metals. J. K. MARSH (J.C.S., 1939, 554—558; cf. A., 1935, 180).—Solubility data for the dimethylphosphates of Gd, Tb, Dy, Y, Er, and Yb are given. The solubilities decrease markedly with increasing temp., and differ widely from one earth to the next, decreasing with increase in at. no., especially in the Y group, and this affords a valuable method of purification. Details of the purification of Tb, Dy, and Ho are given. F. J. G.

Separation and purification of samarium from mixtures of the rare earths by reduction to samarium(-II) chloride. A. BRUKL (Angew. Chem., 1939, **52**, 151—154).—The anhyd. EtOH solution of the rare-earth chlorides is shaken with Ca amalgam in absence of air, and the ppt. of $SmCl_2$ separated by centrifuging. Ca amalgam is conveniently obtained by direct union under 60 atm. pressure. F. J. G.

Acidic nature and methylation of graphitic oxide. U. HOFMANN and R. HOLST (Ber., 1939, **72**, [B], 754—771).—After the most thorough oxidation, the limiting ratio of O to C (after drying) in graphitic oxide is $1 : 2.2$ (approx.). Determination of replaceable H with alkali hydroxide gives results $\gg$ those obtained by the use of acetates, the former corresponding with $H : C \sim 1 : 8$. Methylation by means of $MeOH + HCl$ on the one hand and CH_2N_2 on the other gives results of the same order as are found with acetates and with alkalis respectively. On drying, the results with $MeOH + HCl$ are unchanged, even when the distance between the layer-planes is too small for penetration by the reagents, whereas those with CH_2N_2 diminish. From these results it follows that most of the C atoms are attached to O atoms by their fourth valencies, probably so as to form ethylene-oxide rings, whilst some of them carry OH groups, of phenolic character, capable of reacting with CH_2N_2 and with alkali hydroxide, but not with $MeOH + HCl$ or with OAc', and these on drying lose H_2O, forming the ethylene-oxide ring. In addition, C atoms at the edges of the layer-planes, including the internal edges of " holes," carry CO_2H groups which can react with OAc' and with $MeOH + HCl$. F. J. G.

Preparation of carbon disulphide from methane and hydrogen sulphide.—See B., 1939, 462.

Preparation of pure metals of the titanium group by thermal decomposition of their iodides. V. Titanium. J. D. FAST (Z. anorg. Chem., 1939, **241**, 42—56).—Working details for the prep. of crude Ti by reduction of Na_2TiF_6 or of $TiCl_4$ with Na, and for its conversion into rods of pure Ti by decomp. of the iodide vapour on a hot W filament, are given. Pure Ti has a high ductility which is much impaired by traces of O or N, but not by traces of other elements. It has ρ 4.507 ± 0.005, m.p. $1725°\pm10°$, r 4.2×10^{-5} Ω. per cm. with a temp. coeff. 0.00546, and coeff. of linear expansion 82×10^{-7}. F. J. G.

Atmospheric oxidation of metals and alloys at different temperatures by electron-diffraction. M. BOUND and D. A. RICHARDS (Proc. Physical Soc., 1939, **51**, 256—266).—At room temp. no change ascribable to the formation of an oxide film in the case of Sn, Sb, Pb, Au, Zn, and Al was found. Cu, Fe, and Cd gave rings due to oxides. Ag gave extra rings due to AgS. Bi gave a band in the pattern on exposure to air probably due to a thin film of oxide. At high temp. films of SnO, Sb_2O_3, Cu_2O, CuO, Fe_2O_3, CdO, NiO, ZnO, and Bi_2O_3 were found. N. M. B.

New class of ammines. Complex thiostannates. G. SPACU and A. POP (Bull. Acad. Sci. Roumaine, 1939, **21**, 52—61).—The prep. of the following *compounds* is described : $Na_4SnS_4,10H_2O$; $[Ni on_3][SnS_3]$; $[Co en_3]_4[SnS_4]_3,15H_2O$; $[Cr en_3]_4[SnS_4]_3,8H_2O$; $[Cr(NH_3)_5Cl]SnS_3$; $[Cr(NH_3)_5Cl]_2SnS_4$; $[Cr(NH_3)_5SCN]SnS_4,H_2O$; $[Cr(NH_3)_5SCN]_2SnS_4,2H_2O$. Aq. solutions of thiostannates contain both SnS_4'''' and SnS_3'' ions, their relative concn. being governed by the $[S'']$. D. F. R.

Lead acetato-halides. E. GRILLOT (Compt. rend., 1939, **208**, 910—912).—PbI_2 is more sol. in $Pb(OAc)_2$ (I) than in H_2O, but from hydrated (I) and a little AcOH at 100°, (I) separates. From the reaction mixture, $CHCl_3$ extracts feebly sol. *Pb acetato-iodide*, $Pb_2(OAc)_3I$ (cf. A., 1935, 50). Similarly, with $PbBr_2$, *Pb acetato-bromide*, $Pb_2(OAc)_3Br$ (cf. A., 1935, 1089), is formed. Either when hydrolysed affords $Pb(OH)Hal$ and AcOH. An aq. solution of $(CH_2Cl\cdot CO_2)_2Pb$ saturated with $PbCl_2$ at 56° affords *Pb chloroacetato-chloride*; the corresponding bromide and iodide are not obtained but mixtures of $CH_2Cl\cdot CO_2PbBr + CH_2Br\cdot CO_2PbCl$ and $CH_2Cl\cdot CO_2PbI + CH_2I\cdot CO_2PbCl + Pb(OH)I$, respectively, result.   J. L. D.

Preparation of lead tetra-acetate.—See A., 1939, II, 241.

Tautomerism of nitrous acid. H. KRALL (J. Indian Chem. Soc., 1939, **16**, 9—14).—Quant. study of the decomp. of (i) aq. NH_4NO_2 alone and in presence of AcOH and HCl, and (ii) HNO_2 liberated by AcOH and HCl from $NaNO_2$, in a Lunge nitrometer indicates the

tautomerism $H\cdot O\cdot N\text{:}O \underset{\text{acids}}{\overset{\text{bases}}{\rightleftharpoons}} O\text{:}NH\text{:}O$ for HNO_2.

This explains the results obtained by Macmillan and Reade (cf. A., 1930, 204) and Donald and Reade (cf. A., 1935, 337) on the simultaneous production of NO_2-compounds and nitrosoamines from certain *tert.* aromatic amines.   W. R. A.

Introduction of the azide group into complex salts.—See A., 1939, II, 250.

New class of ammines. Complex selenoantimoniates. Constitution of seleno-salts. G. SPACU, M. VANCEA, and J. DOVAL (Bull. Acad. Sci. Roumaine, 1939, **21**, 62—72).—Five complex *selenoantimoniates* have been prepared from Hofacker's salt, $Na_3SbSe_4,9H_2O$: $[Cr(NH_3)_5Cl]_3[SbSe_4]_2,6H_2O$; $[Cr\ en_3]SbSe_4,2H_2O$; $[Co\ en_3]SbSe_4,2H_2O$; $\{Cr[CO(NH_2)_2]_6\}SbSe_4,5H_2O$; $[Cr_4(OH)_6en_6][SbSe_4]_2,7H_2O$. The existence of the selenoantimonic ion is confirmed; the structure $[SbSe_4(H_2O)_2]'''$ is suggested.   D. F. R.

Heavy oxygen exchange reactions of proteins and amino-acids. W. H. MEARS and H. SOBOTKA (J. Amer. Chem. Soc., 1939, **61**, 880—886).—Exchange of O between proteins and H_2O containing high and low $[^{18}O]$ has been investigated. Of the several different O-containing groups in proteins only CO_2H exchanges and then at p_H 2 but not in neutral solution. In neutral solution ovalbumin does not exchange whilst pepsin exchanges 13%. The significance of the data on the use of ^{18}O in metabolic studies and in the study of protein structure is discussed.   W. R. A.

Interaction of sulphur monoxide with nitrous and nitric acids. C. J. WILKINS and F. G. SOPER (J.C.S., 1939, 600—603).—HNO_2 and HNO_3 in solution in H_2SO_4 are reduced irreversibly to N_2 by SO.
          F. J. G.

Reduction of sulphur dioxide by methane. J. ZAWADZKI, S. OSTROUCH, and G. KWIECIŃSKI (Przemysł Chem., 1938, **22**, 558—564).—The following reactions take place when CH_4–SO_2 mixtures are passed through porcelain tubes packed with SiO_2 :

$2CH_4 + 3SO_2 \rightarrow 2COS + S + 4H_2O$; $2COS \rightarrow 2S + 2CO$; $2COS \rightarrow CS_2 + CO_2$; $2CO + SO_2 \rightarrow S + 2CO_2$. CS_2 is not formed at >900°, and at >1000° only S is formed; small amounts of COS may be formed secondarily, by recombination of CO with S, in the cooler parts of the tube.   R. T.

Reaction of sulphur trioxide with sodium chloride. D. J. SALLEY (J. Amer. Chem. Soc., 1939, **61**, 834—838).—The decomp. of a low-temp. SO_3–NaCl additive complex, formed by passing SO_3 over NaCl at ~90°, yields SO_2 and Cl_2 in exactly equiv. proportions for all temp. between 220° and 44° in N_2 or O_2. Using a static method the reaction between SO_3 and NaCl has been investigated at from 279° to 350° and is represented by $2NaCl + 3SO_3 = Na_2S_2O_7 + SO_2 + Cl_2$.   W. R. A.

Ammonium and substituted ammonium sulphamates. M. J. BUTLER and L. F. AUDRIETH (J. Amer. Chem. Soc., 1939, **61**, 914—915).—NH_4 sulphamate, a fine white powder, was prepared by adding sulphamic acid, $NH_2\cdot SO_3H$, to liquid NH_3; it behaves as a dibasic acid in NH_3. 18 alkylamine sulphamates were prepared by the general reaction : $NH_2\cdot SO_3H + RNH_2 \rightarrow NH_2\cdot SO_3H,NH_2R$. Their m.p. and hygroscopicities have been determined; they are sol. in H_2O and EtOH but not in Et_2O.
          W. R. A.

Insoluble tellurates. E. MONTIGNIE (Bull. Soc. chim., 1939, [v], **6**, 672—676; cf. A., 1935, 834).—The following have been obtained by pptn. : *Zn tellurate*, $ZnTeO_4$, and *basic tellurate*, $ZnTeO_4,3ZnO,4H_2O$ (by using excess of K_2TeO_4 and of $ZnSO_4$, respectively); *basic Zr tellurates*, $Zr(TeO_4)_2,4Zr(OH)_4$ and $Zr(TeO_4)_2,2Zr(OH)_4,H_2O$ [by using excess of $Zr(NO_3)_4$ and of K_2TeO_4, respectively]; *Th tellurate*, $(ThO)TeO_4,8H_2O$ [affords $(ThO)TeO_4,4H_2O$ at 100°]; *basic Cr tellurate*, $2Cr_2O_3,3TeO_3$; *Al tellurate*, $Al_2(TeO_4)_3$; *ceric tellurate*, $Ce(TeO_4)_2$, and *basic tellurate*, CeO_2,TeO_3H_2O [by using excess of K_2TeO_4 and of $Ce(SO_4)_2$, respectively]. On adding a $Sn^{\cdot\cdot}$ solution to an alkali tellurate a white ppt., probably Sn^{II} *tellurate*, is first formed but rapidly decomposes depositing Te.   F. J. G.

Reactions of chromates at high temperatures. VIII. 25% stage in the decomposition of calcium, strontium, and barium chromates. D. S. DATAR, V. T. ATHAVALE, and S. K. K. JATKAR (J. Indian Inst. Sci., 1939, **22**, A, 111—118).—The decomp. of mixtures of $MCrO_4$ and MCO_3 (M = Ca, Sr, Ba) in the ratio $MCrO_4 : MCO_3 = 2 : 1$ has been studied. A 25% decomp. of the chromate occurs owing to formation of $3MO,2CrO_3$ followed by formation of $12MO,6CrO_3,Cr_2O_3$.   W. R. A.

Thiocyanates of chromium diguanides.—See A., 1939, II, 251.

Hydrated sodium dimolybdate. (MME.) Z. SOUBAREW-CHÂTELAIN (Compt. rend., 1939, **208**, 1153—1154).—Na dimolybdate was prepared by adding N-HCl or ·HNO_3 to aq. Na_2MoO_4. It forms white, monoclinic, birefringent crystals of composition $Na_2Mo_2O_7,5H_2O$. H_2O is given off at 120°, and the crystals melt as anhyd. $Na_2Mo_2O_7$ at ~400°. The crystals give an X-ray diffraction pattern identical

with that obtained from $Na_2Mo_2O_7$ prepared by fusion of MoO_3 and Na_2CO_3.　　　W. R. A.

Permolybdates. (MME.) M. E. RUMPF-NORD-MANN (Compt. rend., 1939, **208**, 908—910).—By observation of the intensity of colour developed on mixing equimol. solutions of $(NH_4)_2Mo_2O_7$ and H_2O_2, each in AcOH, it is inferred that 2 mols. of $(NH_4)_2Mo_2O_7$ react with 1 mol. of H_2O_2, the product obtained being probably $(NH_4)_2Mo_2O_8$. The dissociation const. of the per-salt in AcOH of p_H 1 is $2·247 \times 10^{-5}$ at 15°.　　　J. W. S.

Expulsion of fluorine from pure fluorapatite by ignition in presence of water vapour and silica. G. TRÖMEL and W. EHRENBERG (Z. anorg. Chem., 1939, **241**, 107—114).—Pure (synthetic) fluorapatite loses no F when ignited alone or with SiO_2, but when heated in a stream of H_2O vapour it loses F at a rate which increases with rising temp. and is accelerated above (but not below) 1300° by addition of SiO_2. Complete expulsion of F can be attained at 1400° in a stream of H_2O vapour in presence of 5% of SiO_2. The small amounts of F which are lost when rock phosphate is ignited in absence of H_2O are from excess of F present as CaF_2. The expulsion of F by a stream of H_2O vapour in absence of SiO_2 takes place in two stages. The first, corresponding with about half of the F, is rapid, and the crystal structure is apparently unchanged; in the second the lines of hydroxyapatite appear and the reaction is much slower. The effect of SiO_2 is (above 1300°) to accelerate this second stage with formation of α-$Ca_3P_2O_8$ containing SiO_2 in solid solution.　　　F. J. G.

Forms of deposited iron during the thermal decomposition of iron pentacarbonyl in the gaseous phase. D. BEISCHER (Z. Elektrochem., 1939, **45**, 310—313).—At low $[Fe(CO)_5]$, a large no. of small primary particles are formed which unite to form filiform particles. At high $[Fe(CO)_5]$, Fe vapour condenses uniformly on the primary particles to form spherical particles.　　　C. R. H.

Preparation of pure ferrous sulphide. J. V. KARIAKIN (J. Appl. Chem. Russ., 1938, **11**, 1575—1583).—Pure FeS is obtained by passing $1 : 9$ H_2S–H_2 mixture over Fe_2O_3 at 950—1050°.　　　R. T.

Sodium, lithium, and copper ferrites, and their conversion into nitrides. R. S. HILPERT, A. HOFFMANN, and F. H. HUCH (Ber., 1939, **72**, [B], 848—853).—The reduction of Fe_2O_3 by NH_3 at 420° to Fe_2N affords a method for studying the state of combination of Fe_2O_3 in ferrites. Na_2O,Fe_2O_3 is unchanged in NH_3 at 420°, whereas the higher Na ferrites are all converted into Na_2O,Fe_2O_3 and Fe_2N. $Na_2O,5Fe_2O_3$ and higher ferrites have the α-Fe_2O_3 structure; the structures of the intermediate compounds differ both from this and from that of Na_2O,Fe_2O_3. They are only slightly, or not at all, ferromagnetic. Li_2O,Fe_2O_3 has the NaCl structure and is ferromagnetic. Higher Li ferrites, up to $Li_2O,5Fe_2O_3$ have the spinal structure and are ferromagnetic, whilst those containing still more Fe_2O_3 are less magnetisable and have the α-Fe_2O_3 structure. Their stability to aq. reagents increases markedly from Li_2O,Fe_2O_3 to $Li_2O,5Fe_2O_3$, which is almost insol.

in dil. HCl, whilst $Li_2O,6Fe_2O_3$ is again readily sol. With NH_3 at 420°, Li_2O,Fe_2O_3 is unchanged, $Li_2O,2Fe_2O_3$ yields Li_2O,Fe_2O_3 and a different nitride, Fe_3N. With $Li_2O,5Fe_2O_3$, all but one tenth of the Fe_2O_3 is converted into Fe_3N, whilst with $Li_2O,10Fe_2O_3$ all of the Fe_2O_3 is converted into a mixture of Fe_2N and Fe_3N. All Cu ferrites are completely reduced to Cu and Fe_3N by NH_3 at 420°. The way in which the product of reaction of Fe_2O_3 with NH_3 depends on the presence of small amounts of the other oxides is noteworthy.　　　F. J. G.

Chlorosulphonate chlorides. IV. Chlorosulphonates and chlorosulphonate chlorides of metals. G. P. LUTSCHINSKI (J. Gen. Chem. Russ., 1938, **8**, 1864—1869).—The following compounds are obtained by the action of SO_3 on $CoCl_2$, $CdCl_2$, $NiCl_2$, $CuCl_2$, $ZnCl_2$, $SnCl_4$, $SnCl_2$, and UO_2Cl_2 : $Co(SO_3Cl)_2$, $Cd(SO_3Cl)_2$, $Ni(S_2O_6Cl)_2$, $Cu(S_2O_6Cl)_2$, $ZnCl·SO_3Cl$, $SnCl_2(SO_3Cl)_2$, $SnSO_4(SO_3Cl)_2$, and $UO_2(SO_3Cl)_2$.　　　R. T.

Composition of a hydrated double salt of nickel and potassium oxalates. S. R. BRINKLEY, jun. (J. Amer. Chem. Soc., 1939, **61**, 965).—An aq. solution containing 12·44% of $K_2C_2O_4$ and 3·53% of NiC_2O_4, at 30°, was dehydrated over $CaCl_2$. Crystals of the double salt $K_2Ni(C_2O_4)_2,xH_2O$ were deposited until the solution contained 23·1% and 3·1% of the salts respectively. After drying, the crystals were heated to const. wt. at 120°, losing 18·7% of their wt. (3 samples); hence the formula is $K_2Ni(C_2O_4)_2,4H_2O$.　　　W. R. A.

Complex compounds of platinum metals with thio-, seleno-, and telluro-ethers. II. Influence of the medium on formation of cis- and trans-isomerides. E. C. FRITZMAN and V. V. KRINITZKI (J. Appl. Chem. Russ., 1938, **11**, 1610—1619).—The reaction $R_2X + (NHPr_3)_2PtCl_4 \rightarrow PtCl_2,2R_2X$ (R = Me, Et ; X = S, Se) is conducted in H_2O and in org. solvents. In H_2O a mixture of α- and β-isomerides is obtained, the proportion of β-isomeride dominating in dil., and of α-isomeride in conc., solutions; similar effects are observed in EtOH or PrOH, whilst in MeOH, $COMe_2$, or $CHCl_3$ the sole product is the α-isomeride. $(NH_4)_3MCl_6$ and R_2X in aq. EtOH yield the salts $[MCl_3,3R_2X]$ and $NH_4[MCl_4,2R_2X]$ (M = Ir, Rh ; R = Me, Et ; X = S, Se). Pt may be separated from Ir or Rh by adding R_2S to the aq. solution, when Pt is pptd., leaving Ir and Rh in solution; this is heated at 60°, when Rh is pptd.　　　R. T.

Mixed platinum dichlorodiammines possessing a cis-configuration. A. GELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 107—110).—Unlike the case previously recorded (Tscherniaev and Gelman, A., 1939, I, 94), introduction of NH_3 into $NH_4[Pt,C_5H_5N,Cl_3]$ and C_5H_5N into $NH_4[Pt,NH_3,Cl]$ leads in each case to cis-$NH_4[Pt,NH_3,C_5H_5N,Cl_2]$ (conductance at 25° recorded), which with aq. NH_3 gives $NH_4[Pt,(NH_3)_3,C_5H_5N]Cl_2$, with Cl_2 followed by C_5H_5N yields $NH_4[Pt,(C_5H_5N)_2,Cl_4]$, and with $CS(NH_2)_2$ gives $PtCl_2[CS(NH_2)_2]_4$, which with K_2PtCl_4 affords $Pt[CS(NH_2)_2]_4PtCl_4$.　　　F. R. G.

Index to literature of spectrochemical analysis. W. F. MEGGERS and B. F. SCRIBNER (Amer. Soc.

Test. Mat., 1939, 59 pp.).—A review covering 1920—1937.   R. B. C.

Identification of lines in qualitative spectrographic analysis. W. C. PIERCE, O. R. TORRES, and W. W. MARSHALL (Ind. Eng. Chem. [Anal.], 1939, **11**, 191—193).—Nine charts giving a λ scale and an Fe arc reference spectrum are reproduced for the region 2500—5150 A. Analysis lines for 47 elements in the same region are tabulated. The charts can be used with any quartz spectrograph. Directions for their use in qual. analysis are given. An enlarged image of the spectrum is projected on to the chart, and coincidences of projected lines with lines of the map serve to identify the element sought. The time and labour required for an analysis are thus considerably shortened.   L. S. T.

Testing of organic reagents for inorganic analysis. H. M. HAENDLER (J. Chem. Educ., 1939, **16**, 66—67).—Two methods for testing the suitability of org. reagents for use in drop reactions and as pptn. tests are outlined.   L. S. T.

Theories of adsorption indicators. S. G. CHAUDHURY and M. K. INDRA (J. Indian Chem. Soc., 1939, **16**, 81—88).—Cataphoretic velocities of halide particles with and without the addition of adsorption indicator are not in agreement with the theories of adsorption indicators put forward by Fajans and by Kolthoff.   W. R. A.

Determination of radon and thoron content of a closed air space. E. RUMPF, W. FOGY, and W. FRÖHLICH (Ann. Physik, 1938, [v], **33**, 723—732).—Three methods of measurement, from any two of which the Rn and thoron content of a closed air space can be calc., are described. Good agreement is obtained.   O. D. S.

Determination of hydrogen-ion concentration. —See B., 1939, 556.

Rapid determination of moisture.—See B., 1939, 450.

Determination of hydrogen peroxide and related peroxygen compounds. J. S. REICHERT, S. A. McNEIGHT, and H. W. RUDEL (Ind. Eng. Chem. [Anal.], 1939, **11**, 194—197).—Various titration, decomp., and colorimetric methods are discussed critically. Titration with $KMnO_4$ is recommended when org. matter is absent, and with $Ce(SO_4)_2$ when it is present. $TiCl_3$ is recommended for colorimetric determinations. A method based on the potentiometric titration of acid solutions of H_2O_2 with aq. $NaNO_2$ has been worked out for solutions containing coloured org. material. The above methods can also be applied to other peroxides and to perborates.   L. S. T.

Colorimetric determination of chlorine with p-aminodimethylaniline. D. H. BYERS with M. G. MELLON (Ind. Eng. Chem. [Anal.], 1939, **11**, 202—203).—A spectrophotometric investigation shows that Beer's law does not hold for concns. >0·65 p.p.m., and that comparisons of colour should be made within 5 min. Optimum p_H ranges are 2·6—3·4 for concns. ≯0·6 p.p.m. and 3·2—4·5 for concns. > this. At p_H 8—9, the purple tint changes to yellow. $Fe^{...}$ increases the colour intensity, 0·1 p.p.m. being equiv. to ~0·01 p.p.m. of Cl_2. NO_2' decreases the colour intensity by approx. the same extent as $Fe^{...}$. The method presents no advantage over that using o-tolidine.   L. S. T.

Potentiometric studies in oxidation–reduction reactions. IV. Oxidation with potassium chlorate. B. SINGH and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 27—30; cf. A., 1937, I, 633).—KI, $FeSO_4$, $(NH_4)_2SO_4$, $TlCl$, As_2O_3, and K Sb tartrate can be titrated potentiometrically with standard $KClO_3$ in presence of a large excess of HCl. Addition of $KClO_3$ generally causes a steady rise in e.m.f. up to the equiv. point, at which a sharp jump in potential occurs followed by a steady rise. For As_2O_3, however, no change in e.m.f. is evident until the equiv. point is reached. KI shows two breaks in e.m.f. corresponding with (i) the total conversion of KI into I according to $6KI + KClO_3 + 6HCl = 7KCl + 3H_2O + 3I_2$, and (ii) the conversion of the liberated I into ICl at the equiv. point, $3I_2 + KClO_3 + 6HCl = KCl + 3H_2O + 6ICl$.   W. R. A.

Potentiometric studies in oxidation–reduction reactions. V. Oxidation with potassium chlorate. B. SINGH and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 95—99).—Using a Pt electrode coupled with a saturated HgCl electrode $KBrO_3$, KIO_3, $KMnO_4$, and $K_2Cr_2O_7$ have been determined potentiometrically by adding to a known wt. of each salt a known excess of KI and sufficient HCl to keep its concn. >5N. and then titrating the excess of KI with standard $KClO_3$ in an atm. of CO_2. At the equiv. point there is a sharp rise in potential. The reactions take place in two stages; e.g., with $KBrO_3$: $6KI + KBrO_3 + 6HCl = KBr + 6KCl + 3H_2O + 3I_2$; $3I_2 + KBrO_3 + 6HCl = KBr + 6ICl + 3H_2O$.   W. R. A.

Oxygen [perborate] baths and their evaluation.—See B., 1939, 554.

Constant sulphite solution. A. HENDERSON and W. P. McCULLOCH (J.C.S., 1939, 506—507).—Arrangements for keeping and manipulating a standard Na_2SO_3 solution under an atm. of pure CO_2 are described.   F. J. G.

Factors influencing the determination of sulphate as barium sulphate. H. A. FALES and W. S. THOMPSON (Ind. Eng. Chem. [Anal.], 1939, **11**, 206—213).—The effect of varying the different factors involved in the pptn. of $BaSO_4$ from solutions containing different amounts of acid and salts, mainly of K, and especially in presence and absence of KNO_3, has been determined. The results indicate that a complex ion or compound is formed in the aq. KNO_3 and retards pptn. of SO_4'' under certain conditions. In hot solutions the complex is largely broken down, and the SO_4'' quickly pptd. $BaSO_4$ pptd. from M-KNO_3 carries down KNO_3 within the ppt. at the time of pptn. Pptn. is incomplete, and at room temp. continues slowly for several days with continued contamination of the ppt. At 80—90°, the slow pptn. is eliminated. When KNO_3 is added after pptn. the $BaSO_4$ is not contaminated. Ppts. of $BaSO_4$ formed in presence of NO_3' are more sensitive to variations in the conditions of pptn. and treatment

than those formed in absence of NO_3'. Contamination appears to be distributed throughout the pptd. material. Under most conditions the presence of KNO_3 produces high results which may, in extreme cases, reach an excess of 23 wt.-%. Digestion at 80—85° effects a considerable purification of the ppt. Losses in wt. on ignition of ppts. contaminated with KNO_3 increase with an increase in contamination, and with such ppts. more reproducible and more trustworthy results are generally to be obtained by drying to const. wt. at 115° than by igniting. The presence of alkali chlorides lowers the wt. of ppt., counteracting the high effect due to NO_3'. The procedure recommended for the determination of $BaSO_4$ with a precision of 0·2% in 0·01—0·1M-nitrate requires $\not>$0·01M-sulphate solutions which are 0·01—0·001N. with respect to HCl, slow addition (5 min. for equiv. amounts) of 0·05M-$BaCl_2$ to the hot solution with const. stirring until a 5% excess is present, digestion at 80—90° for 12 hr., filtration and washing with 200—300 c.c. of cold H_2O, and drying to const. wt. at 110—120°.   L. S. T.

Standardisation of sodium thiosulphate by copper using perchloric acid. J. J. KOLB (Ind. Eng. Chem. [Anal.], 1939, 11, 197).—Cu is dissolved in ~11M-$HClO_4$, an equal vol. of H_2O is added, and the solution is boiled for 2 min. to expel Cl_2. After dilution to a known vol., aliquot portions are titrated with aq. $Na_2S_2O_3$ in presence of KI, using starch and a sol. thiocyanate as described by Foote (A., 1938, I, 413). [$HClO_4$] from 0·3 to 0·7N. has no effect on the titration val. In artificial light, the end-point tends to be taken too soon. The method agrees with the KIO_3 standardisation of $Na_2S_2O_3$.   L. S. T.

Determination of sulphur [in steel] by combustion in oxygen.—See B., 1939, 496.

Spectrophotometric determination of nitrite, and of nitric oxide in furnace atmospheres. H. A. LIEBHAFSKY and E. H. WINSLOW (Ind. Eng. Chem. [Anal.], 1939, 11, 189—190).—A spectrophotometric investigation shows that the determination of NO_2' by the Griess-Ilosvay reagent is an accurate colorimetric process. For [KNO_3] >0·5 μg. Beer's law is obeyed, and after the first 20 min. keeping for another 30 min. has little or no effect on the results. The reagent can be used for the determination of NO in concns. ~10 p.p.m. after conversion into $NaNO_2$ by shaking with NaOH and air under a pressure of ~1 atm. of N_2, and this method has been applied to the determination of NO in furnace gases.   L. S. T.

Colorimetric determination of nitrogen in steel.—See B., 1939, 495.

Influence of certain anions on the accuracy of the titrimetric method of determining phosphoric acid in solution. A. SREENIVASAN (J. Indian Inst. Sci., 1939, 22, A, 79—92).—Investigation of the titrimetric method of determining H_3PO_4 by $(NH_4)_2MoO_4$ shows that (i) a high temp. of pptn. of the phosphomolybdate and longer periods of keeping give higher results, (ii) in very dil. solution pptn. is incomplete and can be increased by addition of NH_4NO_3 to the reagent, (iii) the chlorides, especially the alkali salts, have a solvent effect on the ppt. (NH_4Cl excepted), (iv)

addition of sulphates, especially $(NH_4)_2SO_4$, up to 2% gives high vals. whilst at >2% low vals. are obtained, (v) free HCl or H_2SO_4 has a pronounced solvent action on the ppt., but neutralisation before pptn. gives correct results, (vi) citric acid has also a solvent effect and can be neutralised satisfactorily only up to 2%, and (vii) the presence of SiO_2 leads to high vals.
          W. R. A.

Determination of phosphorus in steel.—See B., 1939, 496.

Determination of phosphorus in fruits and fruit products.—See B., 1939, 545.

Determination of phosphate in phosphorites.—See B., 1939, 478.

Micro-electric deposition and determination of arsenic. S. TORRANCE (Analyst, 1939, 64, 263—264).—The macro-method described previously (A., 1938, I, 212) is adapted to micro-amounts of As by incorporating the Lindsey-Sand micro-electrolytic apparatus and technique (A., 1935, 46). As is deposited quantitatively with Cu so long as the ratio of Cu to As is $\not>$4 : 1. 0·1 mg. of As is satisfactorily recovered.   E. C. S.

Determination of small amounts of arsenic. W. DIEMAIR and H. FOX (Mikrochem., 1939, 26, 343—348).—In the determination of As by the method of Gangl and Sánchez (A., 1934, 1084) increased accuracy is attained by using H_2 from a cylinder controlled by a fine-adjustment valve and adding $PtCl_2$ to the As solution to catalyse the reduction. Accuracy in the titration is increased by measuring out the ICl necessary to dissolve the As mirror, adding 1·5 c.c. of dil. HCl and 1 c.c. of 10% aq. KCN, and after ¾ hr. titrating the I formed. This solution is then used for dissolving the As mirror, the further amount of I liberated being titrated.   J. W. S.

Modification of Bettendorff's arsenic test. II. Catalysed by mercury. W. B. KING and F. E. BROWN (J. Amer. Chem. Soc., 1939, 61, 968—969; cf. A., 1933, 687).—$HgCl_2$ and Hg_2Cl_2 are equally effective in catalysing the reduction of As compounds by $SnCl_2$. The actual catalyst is probably the Hg atom formed by reduction of the Hg salt.   W. R. A.

Volumetric determination of arsenic, by Ledebur's method, in sedimentary iron ores.—See B., 1939, 491.

Tetraphenylarsonium chloride as an analytical reagent. Titration by iodine. H. H. WILLARD and G. M. SMITH (Ind. Eng. Chem. [Anal.], 1939, 11, 186—188).—The potentiometric titration of $AsPh_4Cl$ (I) by aq. I–KI according to the reaction $AsPh_4{}^{\bullet} + I_2 + I' \rightarrow AsPh_4I_3$ has been investigated. On 4—100 mg. of (I) titrations can be duplicated to within 0·02—0·03 ml. of 0·02N-I. The optimum concn. is 10—50 mg. of (I) per 100 ml., the optimum temp. 20—30°, and the solution must be saturated with NaCl just before the end-point is reached. Direct titration of (I) with I, or titration of excess of I with $Na_2S_2O_3$ in presence of starch or potentiometrically, is not possible in this case. The presence of free acid, except HNO_3, is not objectionable. Large [NO_3'] causes pptn. of $AsPh_4\cdot NO_3$. Alkalis and alkaline earths,

$Ni^{..}$, $Co^{..}$, $Cr^{...}$, $Mn^{..}$, BO_3''', HCO_3', PO_4''', OAc', SO_4'', citrate, and tartrate do not interfere. Tungstate, molybdate, CrO_4'', perrhenate, MnO_4', IO_4', ClO_4', Br', F', and all cations that form complex halide ions interfere. Interference by $Fe^{...}$ is eliminated by the addition of $H_3PO_4 + Na_2HPO_4$, but not citrate or tartrate. Citrate prevents interference by $Cu^{..}$, Sn, $Bi^{...}$, $Zn^{..}$, and $Cd^{..}$. Org. solvents must be absent.   L. S. T.

Determination of arsenic in bismuth salts.—See B., 1939, 549.

Turmeric test-papers containing boron. W. A. N. MARKWELL (Analyst, 1939, **64**, 271—272).—A batch of papers gave a strongly positive reaction for B when the solution under test was B-free, and B was detected in the papers themselves.   E. C. S.

Determination of boron in boron carbide.—See B., 1939, 502.

Determination of silicon in aluminium.—See B., 1939, 504.

Determination of silicon and tungsten in ferrotungsten by the dissolution method.—See B., 1939, 496.

Photocolorimetric determination of silicon, iron, and copper in aluminium alloys.—See B., 1939, 504.

Determination of silicon carbide in carborundum.—See B., 1939, 486.

Determination of soluble silica and alumina in Portland cement.—See B., 1939, 487.

Determination of potassium with the magnesium salt of dipicrylamine. Micro-determination of potassium and a separation of potassium and sodium. R. DWORZAK and H. BALLCZO (Mikrochem., 1939, **26**, 322—342).—K can be determined satisfactorily by pptn. with the Mg salt of hexanitrodiphenylamine (dipicrylamine) (HR) if $\leqslant 50\%$ excess of pure MgR_2 is used. Pptn. is preferably effected hot and the solution is kept ~ 12 hr. before filtration. The ppt. is rinsed with the filtrate and is washed only with small amounts of pure dry Et_2O until this remains colourless. It is dried for 30 min. at 85—90° and cooled over P_2O_5. In the microdetermination solutions saturated with KR are used. In presence of a large excess of Na or Li the solution is warmed (water-bath), with addition of further aq. MgR_2 if necessary, until the KR which is at first pptd. redissolves completely. After allowing the solution to cool during 7 hr. it is kept for 3 days and then filtered, the ppt. being washed with small amounts of 0·07N-MgR_2 saturated with KR, and then with a little Et_2O before drying at 85—95° and weighing. This method permits accurate determination of K in presence of 100 times its concn. of Na.   J. W. S.

[Determination of potassium in fertilisers.]—See B., 1939, 527.

Determination of sodium in water by an indirect method.—See B., 1939, 556.

Determination of calcium in cast iron.—See B., 1939, 492.

Determination of strontium in the presence of calcium. R. N. SHREVE, C. H. WATKINS, and J. C. BROWNING (Ind. Eng. Chem. [Anal.], 1939, **11**, 215).—$CaCO_3$ and $SrCO_3$ are pptd. at 50° by addition of aq. $(NH_4)_2CO_3$, and dissolved in dil. HNO_3. The solution is evaporated on a steam hot-plate and the $Ca(NO_3)_2$ extracted by $COMe_2$ in the cold after contact for 1 hr. The Sr is weighed as nitrate. Recovery of the Sr varies from 99·7 to 99·9%.   L. S. T.

Hydrolytic volumetric analysis by precipitation. II. Determination of barium. E. A. KOCSIS (Acta chem., min., phys. Univ. Szeged, 1936, **5**, 149—152; Chem. Zentr., 1937, i, 1202).—Bromothymol-blue is preferred to Me-red as indicator in the titration of $Ba^{..}$ with K_2CrO_4; the colour-change is sharp with $\not> 15$ c.c. of 0·1N-$BaCl_2$. The method cannot be used for determination of CrO_4'' with $Ba^{..}$. A fourfold excess of $Ca^{..}$ does not interfere.   A. J. E. W.

Determination of magnesium in water.—See B., 1939, 556.

Detection of zinc in presence of iron. G. ERÉNYI (Analyst, 1939, **64**, 271).—In applying the $Fe(CN)_6''''$ test the interference of $Fe^{...}$ due to the formation of Prussian-blue may be overcome by adding an alkali fluoride, with which $Fe^{...}$ reacts to form a non-ionised complex.   E. C. S.

Determination of zinc and copper with morpholine. L. S. MALOWAN (Mikrochem., 1939, **26**, 319—321).—Morpholine ppts. Zn and Cu quantitatively from solutions of their salts and can be used for the determination of these metals, the ppts. obtained being in each case ignited and weighed as oxide. The possibility of using morpholine for general separation of ions of more electro-positive from those of more electro-negative behaviour is discussed.   J. W. S.

Detection and colorimetric determination of zinc in water by dithizone.—See B., 1939, 557.

Qualitative procedure for the analysis of group II. J. L. MAYNARD, H. H. BARBER, and M. C. SNEED (J. Chem. Educ., 1939, **16**, 77—83).—The sulphides are pptd. under special conditions in aq. HCl by means of H_2S, and then treated with a specially-prepared NaHS reagent which dissolves the Sb, Hg, As, Sn, Se, Te, Mo, and Au and leaves the sulphides of Cu, Cd, Bi, Pb, Pt, Pd, Rh, Ru, Ir, Os, and small amounts of metallic Au. The insol. sulphides are examined by a slightly-modified Gilchrist–Wichers procedure (A., 1936, 180) for the Pt metals, which was found to be the most suitable for qual. analysis of this sub-group. Details of procedure are given, and the solubilities of the different sulphides in the NaHS reagent are discussed. $CH_2Ph\cdot NPhMe_2Cl$ is used to confirm Pt ($\not> 3$ µg. of Pt per ml.). The $CS(NH_2)_2$ test for Os is satisfactory. The separation of Bi from the Au, Cu, Cd, Pt, Ir, and Rh is based on the complete pptn. of Bi from its chloride solution with $NaHCO_3$ at p_H 3 (cresol-red). Possible losses of $CdCl_2$ with pptd. NaCl are pointed out. Only relatively high $[Cd^{..}]$ give a ppt. with H_2S in conc. solutions of NaCl. The analysis of the solution of the thio-salts is also detailed. Se is first separated by means of SO_2 in 12N-HCl, and then Te

and Au in 6N-HCl. Finally, the Sb and Sn sulphides are separated from As, Hg, and Mo by dissolution in 12N-HCl. Ge is omitted from the scheme, which is designed for 1—50 mg. of each element.   L. S. T.

Scheme of qualitative analysis, involving the use of organic reagents. J. T. DOBBINS, E. C. MARKHAM, and H. L. EDWARDS (J. Chem. Educ., 1939, **16**, 94—98).—Group I is pptd. as usual, after reduction of any CrO_4'' and MnO_4' by the addition of HNO_3 and H_2O_2. The filtrate is heated with conc. HNO_3 to oxidise $As\cdots$, $Fe\cdot\cdot$, $Sb\cdots$, and $Sn\cdot\cdot$, and AsO_4''' and PO_4''' are pptd. in a small portion by means of NH_4 molybdate and tested for, whilst $Hg\cdot\cdot$ is confirmed in a second portion by means of $SnCl_2$. Group III, consisting of Fe, Bi, Pb, Cr, Al, Sb, Sn, Cu, Co, Ni, Cd, Zn, and Mn, is pptd. by the addition of aq. $C_5H_5N\cdot NH_4CNS$, the first seven ions as hydroxides and the last six as the insol. $C_5H_5N\cdot CNS$ complexes, under carefully-controlled conditions of acidity. The latter, with exception of Mn, are extracted by heating with aq. $NH_3 + NH_4Cl + H_2O_2$ and portions of this solution are examined by means of the org. reagents now in use for drop reactions. The pptd. hydroxides are treated with $NaOH + Br$ to dissolve Al, Cr, Sb, and Sn and then drop reactions, in most cases, are applied for the individual ions. Group IV, Ba, Ca, and Sr, is pptd. with aq. $NH_3 + (NH_4)_2CO_3$ and analysed as usual. In group V, $Mg\cdot\cdot$ is confirmed with diphenylcarbazide, $Na\cdot$ with Zn uranyl acetate, and $K\cdot$ with naphthol-yellow S. PO_4''' and AsO_4''' do not interfere under this scheme. Centrifuging is preferred to filtration for the separation of ppts., and working details and sensitivities of the tests are recorded.   L. S. T.

Polarographic analysis of lead and its compounds.—See B., 1939, 479.

Rapid determination of copper in duralumin-type alloys.—See B., 1939, 505.

Microchemical analysis of brass.—See B., 1939, 498.

Spectrum analysis of brass for manganese, tin, and iron.—See B., 1939, 497.

Determination of copper and manganese in textiles.—See B., 1939, 475.

Conductometric studies. II. Salts of heavy metals (mercuric and mercurous nitrate) and sodium thiosulphate. III. Salts of heavy metals (silver and lead nitrate, copper sulphate) and sodium thiosulphate. J. KAMECKI (Rocz. Chem., 1939, **19**, 213—226, 227—242).—II. Conducto-metric titration of $Hg(NO_3)_2$ (I) with $Na_2S_2O_3$ (II), or vice versa, does not give satisfactory results, owing to the complexity of the reactions involved. For the former case these are represented: $2(I) + 2(II) \rightarrow 2HgS_2O_3$ $(+H_2O) \rightarrow 2HgS$; $2HgS + (I) \rightarrow 2HgS,Hg(NO_3)_2$ $[+(II)] \rightarrow$ unknown further products. In alkaline solution a break in the titration curve takes place when 2 mols. of (II) are added per mol. of (I), corresponding with the reaction $HgO + 2(II) + H_2O \rightarrow Na_2[Hg(S_2O_3)_2]$ (III) $+ 2NaOH$. Titration of $HgNO_3$ is also unsatisfactory; the reactions are probably, $2HgNO_3 + (II) + H_2O \rightarrow HgS + Hg +$

$Na_2SO_4 + 2HNO_3$; $4Hg + 8HNO_3 + 3(II) \rightarrow 3HgS,Hg(NO_3)_2 + 6NaNO_3 + 3H_2SO_4$. In alkaline solution the reactions are: $Hg_2O + 2(II) + H_2O \rightarrow Na_2[HgS_2O_3]_2 \rightarrow$ (III) $+$ Hg. Titration of (II) with $HgNO_3$ appears to involve formation of a complex salt, initially, with its subsequent decomp.

III. Conductometric titration of $AgNO_3$ (IV) with (II), at 50°, gives results slightly $<$ theory, owing to adsorption of $Ag\cdot$ on Ag_2S. The reactions are: $(IV) + (II) \rightarrow Ag_2S_2O_3 + 2NaNO_3$; $Ag_2S_2O_3 + H_2O \rightarrow Ag_2S + H_2SO_4$. Titration of (II) with (IV) gives unsatis-factory results, owing to the slowness of attainment of equilibrium; the reactions are (II) $+ (IV) \rightarrow NaNO_3 + Na[AgS_2O_3]$; $Na[AgS_2O_3] + (IV) \rightarrow NaNO_3 + Ag_2S + H_2SO_4$. Titration of $Pb(NO_3)_2$ with (II), or vice versa, gives accurate results only in fairly conc. solutions, owing to the tendency of PbS_2O_3 to form supersaturated solutions; the reaction is: $Pb(NO_3)_2 + 2(II) \rightarrow 2NaNO_3 + PbS_2O_3$. The results given by conductometric titration of $CuSO_4$ with (I) are 2% high, and of the reverse titration 6% low, the reactions being, respectively, $2CuSO_4 + 2(II) \rightarrow Na_2SO_4 + Cu_2SO_4 + Na_2S_4O_6$, and $Cu_2SO_4 + 2(II) \rightarrow Na_2SO_4 + Na_2[Cu_2(S_2O_3)_2]$.   R. T.

Determination of calomel in compound cathartic pills.—See B., 1939, 549.

Polarographic determination of europium in mixtures of the rare earths. L. HOLLECK (Z. anal. Chem., 1939, **116**, 161—166).—The current–voltage curves reproduced show that Eu can be determined polarographically in presence of other rare earths. The method is more selective, more sensitive, and more accurate than that of X-ray spectroscopy. The rise in the curve corresponding with $Eu\cdots \rightarrow Eu\cdot\cdot$ occurs before that of Zn, which is used as reference substance. Group II metals must first be removed as sulphides, and the rare earths are best converted into chlorides after pptn. as oxalates or hydroxides. With small [Eu], the determination must be carried out in an atm. of H_2, and a dropping Hg electrode for this purpose is described.   L. S. T.

Chemical analysis by artificial radioactivity. Determination of dysprosium in a fractionation of yttria earths. B. GOLDSCHMIDT and O. DJOUR-KOVITCH (Bull. Soc. chim., 1939, [v], **6**, 718—726).—The specimen to be tested is irradiated with slow neutrons, and the resulting activity compared with that induced in standards having a known Dy content. For specimens rich in Gd a correction for absorption can be applied. The method is sensitive to 0·25% of Dy and is a useful control in fractionation.   F. J. G.

Absolute colorimetric analysis of pure aluminium and aluminium alloys.—See B., 1939, 504.

Determination of manganese in steel.—See B., 1939, 496.

Potentiometric determination of small amounts of manganese.—See B., 1939, 501.

Micro-determination of iron in metals and salts by photometric titration.—See B., 1939, 502.

Colorimetric determination of cobalt in ferro-nickel ores.—See B., 1939, 491.

Drop method of detection of tungsten in ores.—See B., 1939, 501.

Volumetric determination of small amounts of tin in ores, using methyl-orange.—See B., 1939, 500.

Determination of titanium in ores, using a mercury cathode.—See B., 1939, 501.

Diphenylmethane calorimeter. D. C. AVDA-LIAN (J. Gen. Chem. Russ., 1938, **8**, 1887—1891).—Irregularities in the action of CH_2Ph_2 calorimeters are due to polymorphous transformations of CH_2Ph_2, both at and above the m.p., which render it unsuitable for calorimetric purposes.   R. T.

Determination of the thermal conductivity and temperature conductivity from the adjustment method with the Schleiermacher tube and the plate apparatus. J. FISCHER. (Ann. Physik, 1939, [v], **34**, 669—688).—Theoretical. The calculation of conductivity for the method of measurement of Pfriem (B., 1938, 743) and Eucken and Englert (ibid., 1110) is discussed. The method can be improved by using the central wire as thermometer alone.
    O. D. S.

Protective arrangement for constant-temperature apparatus heated by electricity. F. TARA-DOIRE (Bull. Soc. chim., 1939, [v], **6**, 739—740).—An arrangement whereby the melting of a plug of fusible material causes the breakage of a Hg contact in the heating circuit is described.   F. J. G.

Method of sensitive pressure and temperature measurement. (A) J. MAZUR. (B) S. ZAMENHOF (Acta Phys. Polon., 1939, **7**, 272, 273—274).—A discussion of priority (cf. A., 1939, I, 158).

Liquefaction of helium. A. VAN ITTERBEEK (Nature, 1939, **143**, 560).—He has been liquefied by using an apparatus based on the Simon expansion principle. Starting at a pressure of 80 atm. and a temp. of 14·6° K., 65 c.c. of liquid He were obtained. The temp. can be lowered to 3·3° K. by reducing the pressure above the He. The time required to obtain liquid He by this method is only 4 hr.   L. S. T.

New method of helium liquefaction by means of the Joule–Thomson effect. I. L. ZELMANOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 25—26; cf. A., 1939, I, 189).—The difficulties referred to in the previous paper can be overcome by means of an additional throttle-valve.   L. J. J.

Thermostatic bath for low-temperature viscosity determinations. E. L. BALDESCHWIELER and L. Z. WILCOX (Ind. Eng. Chem. [Anal.], 1939, **11**, 221—222).—Apparatus for determining η at low temp. is described and illustrated. A temp. control within $\pm 0.03°$ down to $-52°$ can be maintained for several hr.   L. S. T.

Linear coefficient of thermal expansion of ambroid. E. W. YETTER (Rev. Sci. Instr., 1939, **10**, 147).—The linear coeff. of expansion of ambroid (used for bushings in a high-pressure ionisation chamber) varies from 5·36 to 5·56 × 10⁻⁵ from 20° to 60°.   D. F. R.

Thermal conductance of metallic contacts. R. B. JACOBS and C. STARR (Rev. Sci. Instr., 1939, **10**, 140—141).—The thermal conductance across optically polished contacts of Ag, Au, and Cu has been measured at 25° and −195° and under pressures of from 0·2 to 2·5 kg. per sq. cm. The conductance of Cu varies linearly with pressure. Ag is the most suitable for contact work at low temp.   D. F. R.

Dew-point hygrometer for use at low temperatures. C. A. WINKLER (Canad. J. Res., 1939, **17**, D, 35—38).—A cooled non-freezing solution is circulated beneath a mirror provided with 6 thermocouples connected in series. The accuracy of the reading depends on a slow rate of approach to the dew point.   E. C. S.

Simple inexpensive turbidimeter. G. K. ASHBY (J. Lab. clin. Med., 1939, **24**, 654—655).   C. J. C. B.

Photometry. A. DRESLER (Z. Ver. deut. Ing., 1936, **80**, 1405—1408; Chem. Zentr., 1937, i, 1196).—Photometric measurements on discharge tubes by different observers, using flicker and filter methods, give widely discordant results. Physiological causes of the discrepancies are discussed. The use of barrier-layer photo-cells introduces errors of $\pm 10\%$, owing to spectral sensitivity differences between the cells and the eye; the error is reduced by the use of filters.   A. J. E. W.

Preparation of carbon electrodes for spectrographic analysis. A. T. MYERS and B. C. BRUN-STETTER (Ind. Eng. Chem. [Anal.], 1939, **11**, 218—219).—A C-drilling and -cutting tool drill bit and a C-drilling and -pointing tool, made of tool steel, for the prep. of electrodes suitable for the examination of 10—25 mg. of dried plant material or 0·1 ml. of liquid are described and illustrated. Electrodes can be prepared at the rate of 2 per min.   I. S. T.

Ultra-violet spectrography. A. LAMBRECHTS (Bull. Soc. Chim. biol., 1939, **21**, 122—126).—An examination is made of the possible experimental errors associated with the technique of Henri (A., 1912, ii, 882). These errors amount to about 3—4%.   A. L.

Arc source for quantitative spectral analysis [of nickel alloys].—See B., 1939, 499.

Collector for hard X-rays. M. PIERUCCI, M. BACCARANI, and P. TEGGIA (Nuovo Cim., 1938, **15**, 529—531).—The collector consists of a large no. of coaxial cylinders formed from strips of transparent paper which are covered with small, thin plates of graphite. The collector is placed 50 cm. distant from the anti-cathode of a 180,000-v. Coolidge tube.   O. J. W.

Effective wave-lengths in optical pyrometry. F. HOFFMANN and C. TINGWALDT (Z. Instrumkde., 1939, **59**, 20—30).—Theoretical. The problem is considered in connexion with glowing-filament pyrometers with colour filters, and for spectral pyrometers.   A. J. M.

Production of optically active substances and metallic films of silver, platinum, and palladium by means of circularly polarised light. J. C.

GHOSH (J. Indian Chem. Soc., 1939, **16**, 51—62).—An address. W. R. A.

Precision measurement of lattice constants by a compensation method. H. VAN BERGEN (Ann. Physik, 1938, [v], **33**, 737—752; cf. A., 1937, I, 399).—The method of Kossel (A., 1936, 925) is developed for use with external radiation. O. D. S.

Mechanism of the hydrogen electrode process on platinum. J. HORIUTI and M. IKUSIMA (Proc. Imp. Acad. Tokyo, 1939, **15**, 39—44).—Measurements have been made with the H_2 electrode using (a) H_2 and 50% D_2O–H_2O and (b) D_2 and H_2O, and the change in [D] in the gas determined. Calculations of the reaction kinetics show that the H electrode process may be represented by $2H^+ \rightleftharpoons H + H^+ \rightleftharpoons H–H^+ \rightleftharpoons H_2$. D. F. R.

Durable electrode of amalgamated platinum net. F. BISKUPSKI (Pflüger's Archiv, 1938, **240**, 282—286).—The electrode consists of amalgamated Pt net enclosed in an agar gel prepared with 0·9% NaCl and Hg_2Cl_2 in excess. It has the properties of a reversible Hg electrode, i.e., small polarisability and low, almost frequency-independent ohmic resistance, without its disadvantages (e.g., KCl). H. Ro.

Electrometric indicators with the dead-stop end-point system. Applications to neutralisation and precipitation reactions. D. R. CLIPPINGER with C. W. FOULK (Ind. Eng. Chem. [Anal.], 1939, **11**, 216—218).—The method described previously (A., 1926, 927) for iodometry has been extended to neutralisation and pptn. reactions. Various substances, e.g., H_2O_2, $NaNO_2$, are used as electrometric indicators in those cases where an end-point is not given by the reactants alone. When IO_3' and I' are added to an aq. base, the anode of a polarised electrode system is depolarised by the reducing action of the I', and on titration with acid, reaction between IO_3' and I' occurs at p_H 6·67, the trace of I liberated depolarises the cathode, the current flows and is registered by the permanent deflexion of a galvanometer. Details of procedure and results for the titration of NaOH with HCl are given. In acid solution, I is used as indicator, and keeps the cathode depolarised until the first excess of alkali forms a trace of I', which then depolarises the anode, and the current flows. Data for the titration of HCl with NaOH are given. The titration of a strong acid with a weak base also gives a reproducible end-point by this method. H_2O_2 acts as a reversible indicator for the titration of acid or alkaline solutions by virtue of the sharp difference of its reduction potential in acid and alkaline solutions. In the titration of halide by $Ag^•$, $NaNO_2$ serves as indicator by keeping the anode depolarised during titrations; I' and CN' are themselves anodic depolarisers. In the titration of KCN with $Ag^•$, galvanometer deflexions corresponding with the quant. formation of $KAg(CN)_2$ and $Ag_2(CN)_2$, respectively, are observed. Mixtures of Cl' and I', or of Br' and I', can be determined by this method if the AgCl and AgBr are kept in solution by means of aq. NH_3 until the I' is pptd. The dead-stop method has the advantage of using two simple Pt wire electrodes, which seldom become poisoned, and of requiring no

reference electrode. Momentary deflexions of the galvanometer give adequate warning of the end-point, and the results are as reproducible as those obtained by accepted methods of electrometric analysis. L. S. T.

Spectral sensitivity of selenium rectifier photo-electric cells. G. P. BARNARD (Proc. Physical Soc., 1939, **51**, 222—236).—Curves showing the dependence of spectral sensitivity on the external-circuit resistance, output, temp., and on the quality of the incident radiation are given and discussed, and possible methods of colour correction are examined. N. M. B.

Apparatus for electron-diffraction at high temperatures. R. JACKSON and A. G. QUARRELL (Proc. Physical Soc., 1939, **51**, 237—243).—Apparatus and technique for the examination of surfaces by electron-diffraction up to 1200° are described. The diffraction section of the camera is H_2O-cooled, and, since no refractory material is used in the vac. chamber, a high vac. can be maintained. Patterns for FeO at 650° and 850° are reproduced. N. M. B.

Electron-lenses. O. KLEMPERER and W. D. WRIGHT (Proc. Physical Soc., 1939, **51**, 296—317).—Two methods of deriving the optical consts. and spherical aberration of electron-lens systems are described, results for a two-tube lens are reported, and the design of an electron gun for the tests is given. N. M. B.

Deuteron source for nuclear research. N. E. BRADBURY and F. BLOCH (Physical Rev., 1937, [ii], **52**, 256).—In a modification of the usual low-voltage arc in D_2 for deuteron production, a relatively high deuteron yield is obtained by using pressures of 0·1—0·4 mm. and an auxiliary cathode. Excessive gas consumption and high pumping speeds are avoided by the incorporation of an electrostatic focussing system in the arc. Gas consumption is 20 c.c. per hr., and the total power required for operation of the arc is 250 w. L. S. T.

Use of twin sources in experimental studies of thermal neutrons. G. J. THIESSEN and E. L. HARRINGTON (Physical Rev., 1937, [ii], **52**, 256).—By using two sources of Rn–Be placed at an optimum distance apart, a region of nearly uniform neutronic radiation is obtained, and the variations experienced with a single source are eliminated. L. S. T.

Continuously sensitive cloud chamber. A. LANGSDORF, jun. (Rev. Sci. Instr., 1939, **10**, 91—103).—A continuous cloud chamber is described in which supersaturation necessary for condensation of vapour on ions is maintained continuously by the diffusion of an initially warm saturated vapour through a non-condensing gas into a refrigerated region. Convection currents are avoided by diffusion downwards from a heated roof to a cold floor (cf. A., 1937, I, 536). F. J. L.

Use of the neon glow lamp for elimination of induction make shocks. J. E. THOMAS (Science, 1939, **89**, 133—134).—The Ne lamp is put in series with the secondary circuit. W. F. F.

High-performance electronic relay. R. C. HAWES (Ind. Eng. Chem. [Anal.], 1939, **11**, 222—

223).—A relay for use with a Hg thermoregulator in controlling the temp. of a water-bath is described and illustrated.   L. S. T.

National Radium Institute cyclotron and the generation of the first beams of protons and H_2^+ ions. V. RUKAVISCHNIKOV and D. ALCHAZOV (Tech. Phys. U.S.S.R., 1938, **5**, 778—788).—Energies up to $3\cdot18 \times 10^6$ ev. for H^+ and $0\cdot99 \times 10^6$ e.v. for H_2^+ have so far been attained with the instrument described, which is capable of giving field strengths of 18,000 oersted and 6000—12,000 e.v.   L. J. J.

Theory of the thermo-electric couple. V. KOVALENKO (Tech. Phys. U.S.S.R., 1938, **5**, 789—805).—Equations are developed for the temp. attained by the hot junction when used for the measurement of small a.c. or for radiation measurements, and for the time-lag. Consts. characterising the latter for long and short filaments are given for a no. of metals.   L. J. J.

Making beryllium targets. L. C. VAN ATTA, A. M. CLOGSTON, and H. O. PULS (Rev. Sci. Instr., 1939, **10**, 148).—An alternative to the making of Be targets by evaporation of the metal at 1500° is the beating of grains of Be into a Cu block, followed by scraping and sanding. A layer of Be $0\cdot5$ mm. thick is produced.   D. F. R.

Thermo-electric measurement of high temperatures in pressure apparatus. F. BIRCH (Rev. Sci. Instr., 1939, **10**, 137—140).—Up to 580° and 4000 kg. per sq. cm. the e.m.f. of the chromel–alumel couple is independent of pressure to within 10 μv., or $0\cdot25°$. The same pressure causes a regular decrease in the e.m.f. of the Pt–(Pt–10% Rh) couple, amounting to 16 μv., or $1\cdot8°$ at 500°.   D. F. R.

Simple [inductive] capacity (impedance) bridge. J. CHLOUPEK (Chem. Listy, 1939, **33**, 145—149).—Apparatus for measurement of inductive capacity is described.   R. T.

Improved magnetostriction oscillator. W. W. SALISBURY and C. W. PORTER (Rev. Sci. Instr., 1939, **10**, 142—146).—An oscillator with an input of 2000 w. giving frequencies of from 7000 to 50,000 cycles per sec. is described.   D. F. R.

Analytical balances in quantitative micro-analysis. A. A. BENEDETTI-PICHLER (Ind. Eng. Chem. [Anal.], 1939, **11**, 226—229).—Analytical balances of a precision $\ngtr \pm 50$ μg. can be used in quant. micro-analyses when the precision required for the results is not too exacting. The method of weighing employed with microchemical balances is recommended for general use with analytical balances. The min. size of sample required for attaining a specified precision of the analytical result is treated mathematically, and the results are tabulated in a form suitable for their practical application.   L. S. T.

Apparatus for micro-analysis of gas. C. H. PRESCOTT, jun., and J. MORRISON (Ind. Eng. Chem. [Anal.], 1939, **11**, 230—233).—Apparatus and technique are described. The methods are available for H_2O, CO_2, H_2, CO, O_2, and CH_4. A complete general analysis requires 1 hr. With 5—25 cu. mm.

at n.t.p., the errors are $<2\%$ of the total sample, and for smaller samples $\sim5\%$. They appear to be due to adsorption and desorption of gas on the apparatus, particularly on the powdered reagents. Under special conditions, $0\cdot025$ cu. mm. is the limit of detection of a component; the usual limit is $0\cdot06$ cu. mm.   L. S. T.

Duplicating pipettes. F. E. HOLMES (Ind. Eng. Chem. [Anal.], 1939, **11**, 188).—Pipettes of the Ostwald–Van Slyke type with two bulbs instead of one save time and material, avoid unnecessary disturbance of a ppt., and reduce calibration errors.   L. S. T.

Growing of Rochelle salt crystals for radio experiments. C. W. CLIFFORD (J. Chem. Educ., 1939, **16**, 86—87).—Details for producing rapidly and slowly grown crystals are given. The latter averaged 3—4·5 cm. in length, and were stable for >2 years.   L. S. T.

Adsorption analysis : Tswett's chromatographic method. H. G. CASSIDY (J. Chem. Educ., 1939, **16**, 88—93).—The history and theory of the method are reviewed. Working details for an analysis are given, and criteria to aid in the choice of solvents and adsorbents are discussed. Applications and limitations of the method are described.   L. S. T.

Precipitation with hydrogen sulphide in closed vessels. J. PFANHAUSER and T. KALIŃSKI (Przemysł Chem., 1938, **22**, 448—450).—Apparatus for pptg. sulphides in a closed system is described.   R. T.

Theory of the method of Clusius and Dickel for the separation of gases. L. WALDMANN (Naturwiss., 1939, **27**, 230—231).—The theory of the method involving thermo-diffusion and thermo-siphon action for the separation of gases is developed (cf. A., 1938, I, 539).   A. J. M.

Simple laboratory shaking machine. M. C. MARKLEY (Cereal Chem., 1939, **16**, 292—293).—A cheap shaker, constructed for 24 bottles, is described and illustrated.   E. A. F.

Uses for synthetic-rubber-like substances in vacuum technique. J. STRONG (Rev. Sci. Instr., 1939, **10**, 104).—" Koroseal " (Goodrich Rubber Co.) is not attacked by oils and ages more slowly than rubber. It is suitable for gaskets for large-aperture vac. valves, vac. lines, and, since it is unaffected by Hg, for the Hg reservoir in McLeod gauges.   F. J. L.

Jena glass filter test-tubes for micro-analysis. R. NORDBÖ (Skand. Arch. Physiol., 1939, **81**, 263—264).   A. S.

Sintered-glass filters and bubblers of Pyrex. H. W. STONE and L. C. WEISS (Ind. Eng. Chem. [Anal.], 1939, **11**, 220).—The prep. of sintered-glass mats in tubing $\ngtr 10$ mm. external diameter is described.   L. S. T.

Improved stopcock substitute. W. G. PARKS and D. E. CARRITT (Rev. Sci. Instr., 1939, **10**, 148).—The atm. and high-vac. sides of a system are separated by a U-tube. The entrance of Hg into the bottom of the U-tube from a reservoir closes the connexion,

whilst passage of Hg into the system is prevented by sealing a Jena No. 4 sintered disc into each limb of the U-tube.   D. F. R.

Design of an accurate McLeod gauge. P. ROSENBERG (Rev. Sci. Instr., 1939, **10**, 131—136; cf. A., 1938, I, 539).—Details of construction of a large McLeod gauge of high sensitivity, accuracy, and precision are given. The gauge has a compression ratio (ratio of vol. of 1 mm. length of capillary to total vol.) of $2\cdot4 \times 10^{-7}$ and a precision of 0·2, 0·6, 2, and 6% at pressures of 10^{-2}, 10^{-3}, 10^{-4}, and 10^{-5} mm. of Hg respectively.   D. F. R.

Discovery of Ohm's law. R. W. POHL (Forsch. u. Fortschr., 1939, **15**, 158—159).

Historical studies on the phlogiston theory. IV. Last phases of the theory. J. R. PARTINGTON and D. McKIE (Ann. Sci., 1939, **4**, 113—149; cf. A., 1938, 1, 641).

History of Prussian-blue. L. J. M. COLEBY (Ann. Sci., 1939, **4**, 206—211).

J. W. Gibbs. C. A. KRAUS (Science, 1939, **89**, 275—282).   L. S. T.

Geochemistry.

Diurnal variation of the electrical conductivity of air and of the number of ions and nuclei of condensation at the observatory of Chambon-la-Forêt. (MLLE.) O. THELLIER (Compt. rend., 1939, **208**, 1167—1170).—Data for the periods 20 May— 1 November, 1938, and 5—23 February, 1939, are recorded and discussed.   W. R. A.

Salinity of the waters of the Orne between Caen and the mouth (Franceville). C. F. BŒUF (Compt. rend., 1939, **208**, 916—918).—The salinity of the H_2O of the lower Orne has been determined at various locations and times. The region of transition from fresh to salt H_2O varies according to the state of the tide, but although tidal effects are observed at Caen the H_2O there is non-saline.   J. W. S.

Sodium hydrogen carbonate from Searles Lake, California. W. F. FOSHAG (Amer. Min., 1938, **23**, 169).—$NaHCO_3$, α 1·375, β 1·505, γ 1·582, Na_2O 36·74, CO_2 51·15, H_2O 10·76, R_2O_3 0·16, CaO 0·20, insol. 0·82, total 99·33%, occurs with abundant gay-lussite at Searles Lake. " Nahcolite " from near Naples consists of burkeite and $NaCO_3,3NaHCO_3$.   L. S. T.

Ish River mineral springs. Z. N. BLUMSCHTEIN (Sci. Mem. State Univ. Kazan, 1938, **98**, No. 2, 5—203).—An exhaustive description is given of the history, geology, and hydrogeology of a no. of springs on the left bank of the R. Ish, near its confluence with the R. Kama. Numerous analyses of the waters (for solid and gaseous solutes) are given, and conductivity and radioactivity data are recorded.   R. T.

Western Pacific Ocean. II. Chemical composition of the oceanic salt. III. F.p., osmotic pressure, b.p., and vapour pressure of sea-water. Y. MIYAKE (Bull. Chem. Soc. Japan, 1939, **14**, 55—58, 58—62).—Sr in the sea-water, determined gravimetrically, is 14·4 mg. per l. and B, determined volumetrically, is 4·73 mg. per l.

III. The depression of f.p. (ΔT) of the sea-water, containing 18·54% Cl, is 1·895°. The relation between ΔT and % Cl content (C), determined by dilution of the sea-water sample and subsequent f.p. measurements, is $\Delta T = 0\cdot102710C$. The osmotic pressure, b.p. elevation, and v.p. have been calc.   D. F. R.

Iodine value of river waters. M. KOHOUT (Chem. Listy, 1939, **33**, 129—130).—5 c.c. of 20% $KHCO_3$ and 5 c.c. of starch solution are added to 100 c.c. of river- and of distilled H_2O, and the solutions are titrated with 0·01N-I in KI. The I val. (mg. I per l. of H_2O) is raised in river H_2O below cellulose factories, but varies within narrow limits in other cases.   R. T.

Contribution of diatoms to the sediments of Crystal Lake, Vilas Co., Wisconsin. P. S. CONGER (Amer. J. Sci., 1939, **237**, 324—340).—This soft-water lake exhibits an unexpected diversity both in biological stratification and in horizontal distribution of diatoms in its sediments. Diatoms, of which 23 genera and 85 species are tabulated, and pine pollen are the chief constituents of the sediments. Chemical analyses of the lake H_2O at different depths are recorded.   L. S. T.

Structure of meteorites. A. J. BRADLEY (Nature, 1939, **143**, 518—519).—X-Ray powder photographs of the Fe-rich end of the system Fe + Ni provide a new phase diagram which confirms the conclusion (Owen, A., 1939, I, 162) that suitable heat-treatment leads to the production of a two-phase structure in certain alloys. A typical meteoritic structure, consisting of kamacite (body-centred cubic with 6% Ni) + tænite (face-centred cubic with ∼26% Ni), is the equilibrium state between 350° and 580°. A further transformation occurs at ∼350°. The typical meteoritic structure is in equilibrium only between 350° and 580°, and not below 350°. Meteorites may have attained this structure by heat-treatment near the sun while encircling it in a cometary orbit.   L. S. T.

Metalliferous deposits in the region of curvature of the eastern Carpathians. T. P. GHITULESCU (Bull. Acad. Sci. Roumaine, 1939, **21**, 73—80). —A new metallogenetic region, containing sulphides of Pb, Zn, and Cu, with gangue minerals such as quartz, calcite, and barytes, has been discovered. It is situated in the arc of the eastern Carpathians and is a S.E. extension of the metalliferous region east of Transylvania.   D. F. R.

Isomorphic substitutions in apatite. I. D. BORNEMAN-STARINKEVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 113—115; cf. A., 1938, I, 421).—The author upholds his own views on the structure of apatite against those of McConnell (A., 1939, I, 284), which are considered to disregard the

chemical nature of the compound within the lattice. From his calculations it is shown that the sums of the positive and negative charges are unequal and this is regarded as unacceptable.   F. R. G.

Geology of the gold quartz veins of Cornucopia. G. E. GOODSPEED (Amer. Inst. Min. Met. Eng., Tech. Publ. 1035, 18 pp.; Min. Tech., 1939, 3).—The Cornucopia (N.E. Oregon) quartz veins form a parallel vein system traversing metamorphic and granodioritic rocks. Field and petrographic evidence indicates that the veins have been formed by hydrothermal solutions, probably alkaline. The recurrent fracturing of the veins suggests their persistence at depth.   I. C. R.

Geology of the Slana-Tok district, Alaska. F. H. MOFFIT (U.S. Geol. Survey, 1938, Bull. 904, 54 pp.).—The rocks of this district are mainly sedimentary, but include tuff beds and lava flows and many ·masses of intruded granitic rocks, mostly diorite and related types. Evidence of mineralisation by precious metals is discussed.   L. S. T.

Nushagak district, Alaska. J. B. MERTIE, jun. (U.S. Geol. Survey, 1938, Bull. 903, 96 pp.).—The geology of the district is described. Chemical analyses of 4 granites and 3 monzonites are recorded. No metal deposits of commercial val. have as yet been found, but the country is probably mineralised. Au occurs in small quantities at widely-separated localities.   L. S. T.

Lattice limitation of montmorillonite. S. B. HENDRICKS and C. S. ROSS (Z. Krist., 1938, **100**, 251—264; cf. Maegdefrau and Hofmann, A., 1938, I, 347).—Montmorillonite and related minerals (beidellite, nontronite, bentonite) consist of pyrophyllitic silicate layers with interpenetrating H_2O. Views differ as to the detailed structure. A review of, and further evidence from, X-ray and electron diffraction data and optical measurements show that the layers cannot be randomly oriented about their common normal, but have a preferred orientation. Results and interpretations of Hofmann are questioned.
                    I. McA.

Conditions of formation of nitrates in caves. F. W. FREISE (Chem. Erde, 1939, **12**, 265—273).— The nitrates derived from bat guano in limestone caves in Brazil contain 62—88% of $Ca(NO_3)_2$, with some alkali nitrates, and little $Mg(NO_3)_2$. Under certain conditions Cu and Mn nitrates are also formed.
                    L. J. S.

Weathering experiments on leucite. G. KRÜGER (Chem. Erde, 1939, **12**, 236—264).—Finely powdered (radius <1 μ. and 3—10 μ.) leucite was treated at 22° and 42° with solutions of p_H 0—11 (N-H_2SO_4, 0·001N-H_2SO_4, distilled H_2O, CO_2-free H_2O, NH_3 solution), the solution passing continuously through a filtering funnel or an electro-dialyser. With N-H_2SO_4 all K and Al passed into solution, leaving a residue of amorphous SiO_2. With the weaker solvents more Al was dissolved than Si, and the residue left as a film on the grains varied in composition $SiO_2 : Al_2O_3$ from 11·68 to 2·66, depending on the solvent, time of action, and temp.   L. J. S.

Cause of colour of some mineral salts. J. HOFFMANN (Chem. Erde, 1939, **12**, 208—220).—The differences in colour of $CuSO_4$ containing varying amounts of H_2O or as double salts with $NiSO_4$ and NH_3 are noted. Changes in colour shown by various substances when exposed to Ra are discussed in relation to at. structure.   L. J. S.

Basalts of Pauliberg, Burgenland. L. JUGOVICS (Chem. Erde, 1939, **12**, 158—207).—Several chemical analyses are plotted on diagrams and compared with the rocks of other regions.   L. J. S.

Influence of iron and titanium on the physical characters of garnets of the grossular–andradite series. M. T. MACKOWSKY (Chem. Erde, 1939, **12**, 123—157).—Chemical analysis with determinations of ρ, n, and a_0 are given for nine andradites from various localities. Fe_2O_3 ranges from 20·68 to 30·14, and Al_2O_3 0·13—7·53%. The physical data show a linear increase with increase in Fe_2O_3 and TiO_2. For pure andradite ($Ca_3Fe_2Si_3O_{12}$) are calc. ρ 3·750, n 1·895, a_0 12·033 A., and for pure grossular ($Ca_3Al_2Si_3O_{12}$) ρ 3·530, n 1·735, a_0 11·840 A.   L. J. S.

Weathering of igneous rocks in the Chilean desert. E. BLANCK and R. THEMLITZ (Chem. Erde, 1939, **12**, 113—122).—Chemical analyses are given of fresh granite and porphyry and of their weathering products. In one type of alteration of the granite (SiO_2 69·93%) there has been silicification (SiO_2 84·17%) with loss of alkalis. In more disintegrated material there has been loss of SiO_2 (SiO_2 54·27%) and addition of considerable amounts of CO_2, SO_3, and N_2O_5.   L. J. S.

Heavy mineral methods applied to the Pre-Cambrian rocks of the south shore of Lake Superior. S. A. TYLER and R. W. MARSDEN (Amer. Min., 1938, **23**, 180).—On the south shore of Lake Superior, pre-Huronian and Keweenawan igneous rocks can be readily distinguished by the variety of zircon, purple or colourless to yellow, present.
                    L. S. T.

Origin of fibrous gypsum veins in the Lykins and Morrison formations of Colorado. L. R. THIESMEYER (Amer. Min., 1938, **23**, 179—180).—The fibrous structures of these veins, which are locally abundant, are probably not the result of lateral secretion through the wall rocks. The vein material was probably supplied by the Morrison formation to downward-migrating groundwaters.   L. S. T.

Brown iron ores of Eastern Texas. E. B. ECKEL (U.S. Geol. Survey, 1938, Bull. 902, 157 pp.).— The general geology, the Fe ores, and the numerous separate deposits are described. The most abundant ore is limonite (I) (brown ore) with composition range of Fe 48—57, SiO_2 5—13, Al_2O_3 2—7, P 0·04—0·12, S 0·02—0·10, Mn 0·15—0·30, and H_2O 10—13%. Siderite is also plentiful. The laminated and buff crumbly ores of the S. Basin contain Fe 42—48, SiO_2 10—12, Al_2O_3 8—12, P 0·10—0·25, and H_2O 12—14%. The ores appear to have been derived from the Weches greensand by the ordinary weathering processes of leaching, deposition as carbonate, and alteration to (I). Estimated reserves of comparatively high-grade ore are 15—20 × 10⁷ tons. Numer-

ous chemical analyses of the Weches greensand, the brown ores, and the carbonate ores are tabulated. L. S. T.

Rock-salt in Pennsylvania. R. W. STONE (Econ. Geol., 1937, **32**, 1072).—Large supplies of salt, probably halite, are available. L. S. T.

Occurrence of large halite crystals. C. B. SLAWSON (Amer. Min., 1938, **23**, 179).—Large masses of clear, transparent halite are occasionally encountered in the rock-salt mined at Detroit. Single crystals >2 ft. in diameter are not uncommon. L. S. T.

Diadochite, a mineraloid from the New Idria mine, San Benito Co., California. A. F. ROGERS (Amer. Min., 1938, **23**, 178).—A yellowish-brown, resin-like, massive material from the New Idria Hg mine is amorphous, $2Fe_2O_3,3(SO_3,P_2O_5),15H_2O$, analogous to pitticite. L. S. T.

Quartz with pinacoid faces from Nathrop, Chaffee Co., Colorado. A. F. ROGERS and L. CAHN (Amer. Min., 1938, **23**, 178—179).—Minute α-quartz crystals of prismatic habit from Ruby Mt., Chappee Co., Colorado, show prominent pinacoidal faces. L. S. T.

Goldschmidtine, a new silver antimonide. M. A. PEACOCK (Amer. Min., 1938, **23**, 176—177).—*Goldschmidtine* (I), orthorhombic, $a:b:c = 0.6312:1:0.6860$, a_0 7.75, b_0 12.32, c_0 8.42 A. (all ± 0.05 A.) a_0, b_0, $c_0 = 0.629:1:0.683$, vol. of unit cell 804 $A.^3$, ρ 6.83±0.03, mol. wt. 3328, hardness 2.5, the base-centered cell containing $Ag_{20}Sb_{10}$, has [F. A. GONYER] Ag 64.78, Sb 35.01, S 0.06, Pb, As, Cu, and Sn none, total 99.85%, and occurs with native Ag, ruby Ag, and galena on a specimen from Andreasberg, Harz. (I) differs from dyscrasite, Ag_3Sb, in all essential properties. L. S. T.

Cleavage-luminescence in mica. V. B. MEEN (Amer. Min., 1938, **23**, 174).—Mica from Kilmar, Quebec, and certain others, luminesce when split. L. S. T.

Harmotome from Delaware Co., Pennsylvania, a barium zeolite of hydrothermal origin. A. E. MEIER and W. H. TOMLINSON (Amer. Min., 1938, **23**, 174).—Harmotome, probably of hydrothermal origin, occurs in serpentine near Glen Riddle, Pa. Associated minerals are Ba K felspars, corundum, and montmorillonite. L. S. T.

Regional granitisation and metamorphism in New England. L. W. CURRIER (Amer. Min., 1938, **23**, 168).—The origin of granites at Chelmsford-Westford, Mass., and Milford, N. H., is attributed to general intensive granitisation of schists by hydromagmatic processes. Metasomatism has developed alkali felspars, quartz, and muscovite displacing original Mg, Fe, Ca, and Ti. L. S. T.

Mineral deposits of the north-eastern part of the Humboldt range, Nevada. E. N. CAMERON (Amer. Min., 1938, **23**, 167—168).—Hypogene sulphides of the Ag-bearing veins and stockworks include pyrite, sphalerite, freibergite, Ag-bearing galena, and jamesonite, with minor amounts of arsenopyrite, stibnite (I), chalcopyrite, bournonite, and pyrargyrite. Quartz (II) is the chief gangue

mineral. Calcite, barite, albite, apatite, scheelite, and epidote occur in the veins. Covellite, sooty argentite, and native Ag appear to be supergene. The commercial val. of the Ag deposits is probably due to supergene enrichment. Workable quartz-stibnite veins consist of (I) replacing and filling fractures in massive (II). Oxidation of a vein in Jackson Canyon has given workable bodies of stibiconite and (II). L. S. T.

Unweathered manganese deposits of the Batesville District, Arkansas. H. D. MISER and D. F. HEWETT (Econ. Geol., 1937, **32**, 1069; Amer. Min., 1938, **23**, 175).—The conc. bodies of $MnCO_3$ now being explored in this district appear to have been formed by the concn. of the Mn disseminated throughout the Fernvale limestone. The widespread presence of bementite, as well as of neotocite, barite, and fluorite, indicates that warm waters accomplished this concn. L. S. T.

Silicification types along the hanging wall of the London fault, Mosquito Range, Colorado. R. D. BUTLER (Econ. Geol., 1937, **32**, 1071; Amer. Min., 1938, **23**, 167).—Dolomitic formations on this wall contain replacement ore bodies of barite-carbonate–pyrite-sphalerite-galena–tennantite. Silicification of the dolomites preceded the formation of the ore minerals. Two types of replacement SiO_2, idiomorphic and allotriomorphic, have been observed. Distribution of ore is not related to amount of silicification, but valuable ore bodies occur only within a small area where certain silicified facies are present. L. S. T.

Crystal structure and density of delafossite. A. PABST (Amer. Min., 1938, **23**, 175—176).—A discussion. L. S. T.

Nickel content of an Alaskan troctolite. J. C. REED (Econ. Geol., 1937, **32**, 1074—1075; Amer. Min., 1938, **23**, 177).—A troctolite sill occurring on Admiralty Island, Alaska, contains ~0.18% of chalcopyrite and 0.10% of pentlandite, corresponding with 0.06% Cu and 0.025% Ni. A chemical analysis indicates Cu : Ni = 3.5 : 1. L. S. T.

Broader structural relations of the ore deposits of Central City and Idaho Springs, Colorado. T. S. LOVERING and E. N. GODDARD (Econ. Geol., 1937, **32**, 1075—1076).—The structure of the deposits is described and their origin discussed. L. S. T.

Pyrophyllite deposit in S.E. Newfoundland. J. S. VHAY (Econ. Geol., 1937, **32**, 1076—1077; Amer. Min., 1938, **23**, 180—181).—The quartz-pyrophyllite schists occurring near Manuels, Conception Bay, consist of various proportions of quartz and pyrophyllite (I) grading into large masses of nearly pure (I). (I) has been formed by hydrothermal alteration of sheared and silicified rocks. L. S. T.

Fluorite deposits in Westmoreland, New Hampshire. H. M. BANNERMAN and R. E. STOIBER (Econ. Geol., 1937, **32**, 1077—1078; Amer. Min., 1938, **23**, 166).—These deposits occur as fissure fillings in tension fractures in a granite gneiss. The fluorite is accompanied mainly by quartz, but considerable amounts of barite, calcite, dolomite, kaolin, and sericite are present. Sulphide streaks with some

malachite and smithsonite occur throughout the deposits. The veins are probably post-Palæozoic.
L. S. T.

Magmatic carbonation–carbothermal metamorphism. R. J. HOLDEN (Econ. Geol., 1937, **32**, 1078—1079).—The results of mass action of magmatic CO_2 can be recognised by the association of carbonates with chlorite, epidote, and other secondary hydrous silicates in deep veins and intrusives in katamorphic changes at depths and temp. where only anamorphic actions would be expected. Magmatic CO_2, in some cases aided by S, may produce sericitisation, propylitisation, alunitisation, silicification, and pyritisation.
L. S. T.

Platinum placers of the Goodnews Bay district, Alaska. J. B. MERTIE, jun. (Econ. Geol., 1937, **32**, 1080).—Placer Pt has been found only in a small area south of Goodnews Bay. Production for 1937 is ~5500 oz. The country rock consists of sheared and semi-schistose rocks of sedimentary and igneous origin, and lava flows, all probably Carboniferous. The chief Pt placers occur in the valley of Salmon River and in two tributaries, the Platinum and Clara Creeks. All six Pt metals are present with 68—75% of Pt, 6—13% of Ir, and 0·25—0·5% of Pd. 0·25—0·5% of Au is also recovered. Concentrates taken with the precious metals include magnetite, ilmenite, and chromite.
L. S. T.

Gold deposits of northern Oriente, Cuba. T. T. QUIRKE (Econ. Geol., 1937, **32**, 1081).—At Halguin, the deposits occur in irregular veins and disseminations, whilst near Santa Lucia, the Au occurs in rough coarse and fine grains within massive serpentine rocks, in quartz veins, in massive arsenopyrite concns., and in shatter zones. Nearly all the local gravels and other alluvium contain free Au.
L. S. T.

Gold in the Baleisk mine (Transbaikal). O. E. ZVJAGINTZEV, V. A. VOLKOVA, and E. L. PISARJEVSKAJA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 509—518).—Up to 120 m. depth, the composition, microstructure, and Ag content of the Au are const. The K content is very high in comparison with granites. All the component elements and ions have V.E.K. 0·32—1·1 kg.-cal. per mol.
L. J. J.

Origin of primary lead ores. II. A. HOLMES (Econ. Geol., 1938, **33**, 829—867).—A reply to criticism (cf. Graton, A., 1938, I, 542; Keevil, A., 1939, I, 288). Knopf's alternative suggestion (A., 1938, I, 283) that ore-Pb is a differentiate from deep-seated peridotite via basaltic granitic magmas is without foundation.
L. S. T.

Fluoride with pyrochlore structure. A. PABST (Nature, 1939, **143**, 520—521).—X-Ray investigation of ralstonite (I) gives a_0 9·87 A., space-group O^{h7}—$Fd3m$. The unit cube contains 48 (F, OH), 16 (Al, Mg), 2·7 Na, and 7 H_2O. The structure is similar to that of the pyrochlore group $X_2Z_2(O,OH,F)_7$. (I) can be dehydrated without destroying the crystal lattice.
L. S. T.

Occurrence of vanadium in nature. F. HERMANN (Metallwirts., 1936, **15**, 1007—1015; Chem. Zentr., 1937, i, 814).—The natural enrichment of V

in magnetites, other Fe and Mn ores, and bitumens is discussed. World sources are reviewed and classified.
A. J. E. W.

Hydrothermal formation of clay minerals in the laboratory. F. H. NORTON (Amer. Min., 1939, **24**, 1—17).—A continuation of former work (A., 1937, I, 206) and an extension to other minerals in which rates of reaction at different temp. and over various ranges of pressure of CO_2 have been determined. Albite is comparatively stable and its conversion into beidellite (?) is slow. At 300° and 500 lb. per sq. in. of CO_2, nephelite is rapidly converted almost completely into gibbsite (?), but at 275° or 325° and the same pressure, the end-product is sericite (I). Orthoclase and leucite are also converted into (I). At 300° and 250 lb. per sq. in., petallite gives a 50% conversion into a product that has an X-ray pattern similar to, but not identical with, that of kaolinite (II). At 300° and 500 lb. pressure, spodumene is converted completely into (II), and anorthite into pyrophillite (90% yield), whilst pollucite, beryl, lepidolite, and (II) remain unchanged. Below 250° and above 350°, the above parent minerals appear to be stable. The end-product is determined not only by temp., pressure, and p_H, but also by some characteristic of the parent mineral. Reaction proceeds directly to a single end-product without the formation of intermediate minerals.
L. S. T.

Adsorptive clays of the Texas Gulf Coast. A. F. HAGNER (Amer. Min., 1939, **24**, 67—108).—13 clay deposits of this coast are described, and the results of optical, chemical, and X-ray investigation of the clays are discussed. The principal mineral constituent of the clays as mined is montmorillonite (I). Many beds represent the alteration in situ of volcanic ash. Substantial amounts of kaolinite, halloysite, and allophane occur in some of the deposits. Much of the original material has altered sufficiently to form usable adsorptive clays. The waxy character of certain moist clays is a convenient field indication of adsorptive capacity, and the waxy clays contain more nearly pure (I) than other types which are soft, granular, and kaolinitic. Correlation of mineralogical characteristics with adsorptive capacity indicates that granular or inseparable impurities lower adsorptive capacity, but that there is no relation between microscopic texture and structure and adsorptive efficiency. Strongly adsorptive members of the (I) group have much loosely-bound H_2O, and clay minerals with the (I) lattice have a structure which permits high adsorption. The amount and degree of alteration of original material to clay appear to be related to adsorptive capacity, and completely-altered bentonite forms the best activable clay. Adsorptive clays originating by transportation of material tend to contain more granular impurities than those altering in situ and seem to be active, but poorly activable. Chemical analyses [E. EMENDORFER] recorded for raw and activated clays show a considerable increase in SiO_2 with a corresponding decrease, in most cases, of Al_2O_3, MgO, CaO, and Fe_2O_3, indicating that high % of removable bases accompanies high adsorptive capacity. (I) is the most highly adsorptive clay mineral studied.
L. S. T.

Earth structure and earth origin. K. F. MATHER (Science, 1939, **89**, 65—70).—An address. L. S. T.

Calculation of geological age. N. B. KEEVIL (Amer. J. Sci., 1939, **237**, 195—214).—New equations for computing the age of rocks and minerals from radioactivity data are developed. Errors in former work are discussed. By a suitable choice of equations, any desired degree of accuracy in calculation of the age can be obtained for all methods involving the accumulation of Pb and He from the Th, U, and actino-U series. At low ages the simple equation incorporating recent vals. of the disintegration consts. is satisfactory, whilst for rocks of high age the new equation given can generally be applied. L. S. T.

Oxygen method for geological age determination based on atomic disintegration; application to Karelian, Wilberforce, and South Dakotan uraninites. V. G. CHLOPIN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 489—497).—The geological age is calc. from the $UO_2 : UO_3$ ratio on the assumption that the U was originally present solely as UO_2, and that the O content has remained const. The applicability and limitations of the method are discussed, particularly in relation to the Pb method. L. J. J.

Geological age of uraninites and monazites from the pegmatite veins of north Karelia. V. G. CHLOPIN and M. E. VLADIMIROVA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 499—508).—The Pb method gives close agreement between secondarily unaltered samples from the same or different veins; secondary alteration causes too high vals. No change of Pb : U ratio occurred during crystallisation. Results by the O method (cf. preceding abstract) are in agreement. North Karelian and Manitoban monazites give ages (by Pb method) > those of associated uraninites. The upper limit for North Karelian pegmatites is 1600×10^6 years. L. J. J.

Nitrogen, argon, and neon in the earth's crust with applications to cosmology. (LORD) RAYLEIGH (Proc. Roy. Soc., 1939, **A**, **170**, 451—464).—The ratio of A to Ne was determined for a no. of plutonic rocks by extracting the gases by heat. The method of manipulation of the gases is described. The ratio Ne : A is of the same order as the ratio of the gases in the atm., a fact which is not in favour of the view that there has been a loss of Ne from the atm. Pumice stone contains an exceptionally high proportion of Ne. The rocks examined contained about 0·04 c.c. of N per g.; the N is mainly in combination. It is concluded that the rocks contain in all ∼ 50 times as much N as the atm.; it is not necessary to regard the atm. as primitive and no difficulty arises as to why the earth did not lose its N when its temp. was high. G. D. P.

Cause of the colour of the blue quartzes of the charnockites of South India and of the Champion gneiss and other related rocks of Mysore. N. JAYARAMAN (Proc. Indian Acad. Sci., 1939, **A**, **9**, 265—285).—The blue colour of charnockite quartz and opalescent blue quartz from the Champion gneiss is due to the presence of Ti, and the intensity of colour is ∝ [Ti]. The coloured quartzes show a brownish-yellow turbidity in transmitted light, the intensity of which is ∝ the intensity of the blue colour in reflected light. The turbidity is also due to Ti. Heating destroys the blue colour and the turbidity. The various types of quartz have been examined microscopically and chemically. W. R. A.

Siliceous sinter from Vis Island (Lissa), Dalmatia. S. MIHOLIĆ (Bull. Soc. scient. nat. Croat, 1937—1938, **49/50**, 49—56).—The sinter contains SiO_2 73·15, Al_2O_3 0·24, Fe_2O_3 0·15, MgO 0·02, CaO 15·98, Na_2O 0·14, K_2O 0·12, H_2O+ 0·07, H_2O- 0·03, CO_2 10·46, SnO_2 0·0027, PbO 0·0212, ZnO 0·0265, SrO 0·0280, BaO 0·0007, total 100·44%. L. S. T.

Sedimentary siliceous rocks, hornstone, and the flint problem. J. KÜHNEL (Z. deut. Geol. Ges., 1939, **91**, 207—231).—The possible origin of hornstone and flint is discussed. L. S. T.

Is a thermal hypothesis of flint formation possible? W. WETZEL [with D. WIRTZ] (Z. deut. Geol. Ges., 1939, **91**, 231—236).—Kühnel's views (preceding abstract) are criticised. L. S. T.

Thermoluminescence in several marbles. M. DÉRIBÉRÉ (Bull. Soc. Franç. Min., 1938, **61**, 295—296).—The orange thermoluminescence which occurs in many marbles and breccias is not closely associated with their age. It appears most often as luminous points, and seems to be connected directly with crystallisation. Marbles showing thermoluminescence are enumerated. L. S. T.

Attapulgite. J. DE LAPPARENT (Bull. Soc. Franç. Min., 1939, **61**, 253—283).—A reply to criticism (A., 1937, **1**, 484; A., 1938, 1, 218) and a reiteration of the author's views (A., 1938, I, 52). The mineral constituent of Attapulgus clay is not montmorillonite. L. S. T.

Mineralisation of the deposits of Bucium, Alba District. T. P. GHIŢULESCU and D. GIUŞCĂ (Bull. Acad. Sci. Roumaine, 1938, **20**, 34—44).—The general geology and mineralisation of the district are described. The distribution of the sulphide minerals and sylvanite, hessite, altaite, and petzite in the Arama vein is described. Enargite (analysis given) is recorded from Rumania for the first time. L. S. T.

Leverrierite from the lateritic formations of French West Africa. J. DE LAPPARENT and R. HOCART (Compt. rend., 1939, **208**, 1465—1467; cf. A., 1934, 387).—The detection (by the Debye-Scherrer method) and occurrence of the mineral are described and discussed. A. J. E. W.

Tin deposits of the Black Hills, South Dakota. E. D. GARDNER (U.S. Bur. Mines, 1939, Inf. Circ. 7069, 78 pp.).

H. Ungemach, 1879—1936. R. HOCART (Bull. Soc. Franç. Min., 1938, **61**, 142—172).—A review of Ungemach's contributions to crystallography. L. S. T.

Factors in oil accumulation. V. C. ILLING (J. Inst. Petroleum, 1939, **25**, 201—225).—An investigation of the influence of texture and buoyancy in the flow of oil and H_2O mixtures through sands and its bearing on oil accumulation. T. C. G. T.

A., I.—General, Physical, and Inorganic Chemistry

JULY, 1939.

Intensity of the Stark effect components in hydrogen. Theoretical calculation for stronger fields. E. GUSTAFSON (Z. Physik, 1939, 112, 453—463).—Intensities of the Stark effect components are calc. to a first approximation for the first four states of H. The two components of longer and shorter λ for the initial states 4, 3, and 2 show a dissymmetry of 9·5, 4·8, and 1·8% respectively in a field of 500 kv. per cm. H. C. G.

New band in the arc spectrum of nitrogen. P. TRAUTTEUR (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 218—220; Chem. Zentr., 1936, ii, 3633—3634).—An arc in N_2 (40 mm.) gives an intense band containing two rotational systems, $v_1 = 29002·6 + 27·500J + 0·090J^2$, and $v_2 = 29002·6 + 27·542J + 0·128J^2$. $B'_1 = 13·795$, $B''_1 = 13·705$, $B'_2 = 13·836$, and $B''_2 = 13·707$. A. J. E. W.

Spectrum of the night sky in the ultra-violet region. A. ARNULF, R. BERNARD, D. CAVASSILAS, and G. DÉJARDIN (Compt. rend., 1939, 208, 1329—1331).—λλ of 13 absorption and 135 emission lines at 2867—4052 A. are recorded, relative intensities being given for the emission lines. The occurrence of N_2 (2P), Vegard–Kaplan, CN, O_2 (Schumann–Runge), N_2^+, NH, OH, and O_3 band systems is confirmed; that of NOβ, CH, N I, and Na bands or lines is less certain. The most intense and characteristic lines (3818, 3651, 3555, 3488, 3377, 3220, and 3029 A.) are unidentified. A. J. E. W.

Mechanism of excitation of the forbidden lines of oxygen and nitrogen in the spectra of the aurora and the night sky. M. NICOLET (Nature, 1939, 143, 639).—A new excitation mechanism for the forbidden line of N I and for the increasing intensity of the red O I line with height and auroral type is put forward. L. S. T.

Existence of the phosphorescence of oxygen in the spectrum of the night sky. L. HERMAN and (MME.) R. HERMAN (Compt. rend., 1939, 208, 1392—1394).—Apart from lines and bands the spectrum of the night sky is partly continuous in the green and blue. This is attributed to phosphorescence of O_2 because of its similarity to the phosphorescence spectra of mixtures of O_2 and N_2, and a mechanism of excitation is suggested. W. R. A.

Continuous emission spectrum accompanying the resonance lines of neon. T. TAKAMINE, T. SUGA, Y. TANAKA, and G. IMOTANI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 35, 447—454). —When a condensed discharge is passed through a tube containing Ne and a little N_2 a continuous emission spectrum is observed beginning with the Ne line 744 A. $(1^1S_0 - 2^3P_1)$ and extending to about 795 A., where it disappears rather abruptly. The longer-λ limit of the emission corresponds with the $^2\Sigma_g^+(X')$ level of N_2, and the phenomenon may possibly be a resonance effect between excited Ne atoms and N_2 mols. A. J. M.

Spark spectrum of silver in vacuo. L. BLOCH, E. BLOCH, and L. KOUANG-TAO (Compt. rend., 1939, 208, 1214—1216).—More than 1000 new lines have been observed in the spectrum (2300—6800 A.) of a condensed spark between Ag electrodes 0·5 mm. apart, in a vac. Lines rendered diffuse by atm. effects become measurable. The Ag I—IV systems are readily separated, Ag III and IV being well-developed. The continuum is not less intense than that of a spark in air, showing that its occurrence is not due to foreign gases. A. J. E. W.

Spectrum of γ Cassiopeiæ in the photographic region. II. R. B. BALDWIN (Astrophys. J., 1939, 89, 255—282; cf. A., 1939, I, 50).—The changes of structure and intensity in the emission and absorption lines of H, He I, Fe II, Si II, and Mg II are discussed for the interval 23rd March, 1935, to 24th October, 1938. L. S. T.

Development of the electron avalanche in the path of a spark. H. RAETHER (Z. Physik, 1939, 112, 464—489).—A series of cloud-chamber photographs shows the initiation and development of an electron avalanche under various conditions of pressure, field strength, and electron shape. Conditions governing the development of these phenomena into the spark discharge are considered theoretically. H. C. G.

Azimuthal intensity distribution of Röntgen retardation radiation in the potential region 60—170 kv. S. THORDARSON (Ann. Physik, 1939, [v], 35, 135—146).—Measurements of the relative intensity of X-rays from Al and W anticathodes excited by electrons of 60—170 kv. have been made at angles from 0° to 97° to the direction of the electron beam, and with varying thicknesses of Cu up to 12 mm. as filter. With max. filtration, giving λλ near the threshold vals., the intensity max. shifts towards smaller azimuthal angles with increasing electron velocity in agreement with Sommerfeld's theory for 60—110 kv.; at higher velocities the angle is < the theoretical val. as a result of electron diffusion. The latter may also be the cause of an apparent influence of the degree of filtration on the position of the max. The ratio of max. intensity to intensity at 90° to the electron beam increases with electron velocity, and is smaller for W than for Al, as a result of diffusion. L. J. J.

Scattering of X-rays by crystals away from directions of selective reflexion. J. LAVAL (Compt. rend., 1939, **208**, 1512—1514).—The intensity of scattered X-rays in the neighbourhood of the Bragg angles has been studied in sylvine, calcite, diamond, and Al, by an ionisation method. Data are given for the {004} zone of sylvine; a method of expressing the results in the form of isodiffusion surfaces is developed; {004} giving a surface which is symmetrical about an axis corresponding with the zone. The {002} zone is similar, but {006} gives a surface with four max. owing to interference of neighbouring zones. The scattering is due to thermal agitation. A. J. E. W.

X-Ray interferences of self-irradiated iron. G. BORRMANN (Z. Krist., 1938, **100**, 228—233; cf. A., 1937, I, 55).—The interference patterns obtained from thin crystal plates of Fe, Ag, and Cu, using a conical slit, are illustrated and discussed with reference to crystal thickness, angle of reflexion, and line intensity. I. McA.

K-Röntgen spectrum of titanium and titanium oxide. V. H. SANNER (Z. Physik, 1939, **112**, 430—435).—The K-spectrum of Ti and TiO_2 has been investigated with a vac. spectrograph. The differences Ti → TiO_2 have been determined for $K\alpha_1$, α_2, β_1, β_5, and β'_5. H. C. G.

Surface structures of possibly atomic dimensions using autelectronic or "field" emission from fine metal points. M. BENJAMIN and R. O. JENKINS (Nature, 1939, **143**, 599).—Patterns of the emission from fine metal points under autelectronic conditions can be identified as corresponding with the main planes in the crystal lattice. The patterns obtained and reproduced for W are made up of twinkling spots corresponding with areas of at. dimensions. The technique, which is a modification of that described by Müller (A., 1938, I, 301), is suitable for the study of metallic surfaces and their contamination. L. S. T.

Townsend coefficients for ionisation by collision in pure and contaminated hydrogen as a function of the cathode material. D. H. HALE (Physical Rev., 1939, [ii], **55**, 815—819).—Using cathodes of Pt and Na- and NaH-coated Pt, coeffs. were measured for pure Hg-free H_2 and for H_2 contaminated with Na and NaH vapour. Vals. of α/p are, in general, smaller for pure H_2 than for H_2 contaminated with Hg vapour (cf. Bowls, A., 1938, I, 167), Na, or NaH. Curves for α/p, β/α, and γ as a function of X/p are given and the significance of peaks is discussed. The peaks indicate relatively large photo-emission effects at the cathodes at the lower vals. of X/p. In the case of the Pt cathode at the higher vals. of X/p the curves show a general rise caused by electron emission due to the bombardment of the cathode by positive ions. The vals. of β/α and γ for the Na surfaces are ≪ in the case of Pt for the higher vals. of X/p, indicating that these surfaces are relatively poor emitters under positive ion bombardment. Sparking potentials measured at each val. of X/p give curves in fair agreement with those of Ehrenkranz (cf. A., 1939, I, 168), and in rough

agreement with curves obtained from vals. calc. from the γ-coeffs. N. M. B.

Ionisation of sodium atoms at the surface of thoriated tungsten. N. D. MORGULIS and B. I. DIATLOVITSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 165—167).—Evidence of the non-uniformity of the Th-W surface is derived from measurements of the thermal ionisation of Na at the surface at 1400° and 1700° K. E. S. H.

Liberation of secondary electrons from metal surfaces by electron impact. P. COLOMBINO (Nuovo Cim., 1936, **13**, 205—213; Chem. Zentr., 1936, ii, 3640).—Secondary emission from Cu becomes const. after degassing for 2—15 hr. (according to thickness) at a bright red heat. After interruption of the heating the emission coeff. (k) remains const. for some min. and then rises, again reaching a const. val. after several hr. k is max. for ~500-e.v. primary electrons. Traces of gas interfere. A. J. E. W.

Diffuse scattering of fast electrons in electron interference photographs. H. NIE (Ann. Physik, 1939, [v], **35**, 97—106).—The energy losses of electrons scattered by passage through 0·1 μ. of Au and by a Cu_2O surface at grazing incidence have been determined by utilising the chromatic aberration of a magnetic lens. For electrons of 49 and 78·5 kv., diffuse scattering is associated with <0·4% loss of energy in the case of transmission through Au. In the grazing experiments the losses were greater. L. J. J.

Creation of pairs or positrons by fast electrons. H. R. CRANE and J. HALPERN (Physical Rev., 1939, [ii], **55**, 838—844; cf. A., 1938, I, 291).—An examination of 2588 traversals of 1—12-Me.v. electrons through mica, Pb, and Pt and cloud-chamber tracks in air gave no indication that the cross-section for pair formation by electrons is abnormally large for energies <12 Me.v. in substances of either high or low at. no. as reported by other investigators. Results showed general agreement with theory. Available theoretical and experimental data are reviewed. N. M. B.

Positive beam in cathode-ray tubes. J. FORMAN (Nature, 1939, **143**, 598—599).—The occurrence of a beam of positive ions in commercial high-vac. cathode-ray tubes in certain conditions is described. The production of these ions is probably a secondary effect from the primary electron beam, due to a trace of residual gas in the tube. The fluorescent screens are badly damaged. L. S. T.

Formation of helium molecules. II. F. L. ARNOT and M. B. M'EWEN (Proc. Roy. Soc., 1939, A, **171**, 106—120; cf. A., 1938, I, 429).—The formation of ionised He mols. was studied by means of a mass spectrograph. It is shown that the mol. ion is formed by the attachment of excited atoms in S-states to normal atoms in the ground state. The results are compared with those obtained for Hg mol. ions. G. D. P.

Coefficient of absorption of small ions by neutral particles in suspension in air. O. TE-TCHAO and H. LE BOITEUX (Compt. rend., 1939, **208**, 1288—1289).—The coeff., α = 1·62 × 10^{-7}, is deduced from the ratio of the nos. of large ions and neutral

particles (P/N_0, cf. A., 1939, I, 169) and the coeff. of recombination of large and small ions. It is deduced that ~10 ion-pairs per c.c. per sec. are produced in the atm. by radioactive and cosmic radiation.

A. J. E. W.

Dissociation, recombination, and attachment processes in the upper atmosphere. D. R. BATES, R. A. BUCKINGHAM, H. S. W. MASSEY, and J. J. UNWIN (Proc. Roy. Soc., 1939, A, 170, 322—340).— A theoretical investigation of the recombination coeff. for electrons assuming that the process is one of direct capture into a discrete quantum state with emission of radiation. The process occurs at a rate quite insufficient to account for the observed rate of recombination. It is suggested that the observed recombination is to be accounted for by the reaction of negative and positive O ions.

G. D. P.

Packing fraction differences among heavy elements. A. C. GRAVES (Physical Rev., 1939, [ii], 55, 863—867; cf. Dempster, A., 1938, I, 111).— New packing fraction difference measurements are reported for Cr, Gd, Au, Lu, Mo, Os, Pt, Ru, Sr, Ta, Sn, U, Yb, and Zr. By combining these differences with known packing fractions a no. of new packing fractions are deduced and plotted. The recalc. at. wt. of Os is 190·38 (chemical val. 191·5); that of Lu is 174·96 in agreement with Hönigschmid's chemical val.

N. M. B.

Proton groups emitted during α-ray bombardment of substances containing hydrogen. T. SAN-TSIANG (Compt. rend., 1939, 208, 1302—1303).— Bombardment of Cellophane, cellulose acetate, and paraffin wax with α-particles from Po causes emission of protons in six discrete groups, which are shown by Wilson chamber measurements to have ranges of 6·2, 7·8, 10·0, 11·7, 13·5, and 16·2 cm., corresponding with α-particle ranges (R_a) of 1·58, 1·88, 2·26, 2·64, 3·04, and 3·54 cm., respectively. These groups correspond with resonance levels of the composite nucleus, $^4_2$Li. The ratio of the experimental cross-section to that calc. from Coulomb's law approaches unity only for $R_a \leqslant 1$ cm., showing that interaction of $^4_2$He and $^1_1$H nuclei commences with an inter-nuclear distance of ~8 × 10⁻¹³ cm. The angular variation of the cross-section shows that $^4_2$He orbital moments with $l = 0$ and 1 are involved in the process; the total effective cross-section for a solid angle of 2π is ~2 × 10⁻²¹ sq. cm.

A. J. E. W.

Scattering of α-particles by argon, oxygen, and neon. G. BRUBAKER (Physical Rev., 1939, [ii], 55, 877; cf. A., 1939, I, 114).—A correction. Corr. vals. for nuclear radii are: O, 3·5 × 10⁻¹³; Ne, 4·0 × 10⁻¹³ cm.

N. M. B.

Excitation functions for neutrons from beryllium and boron obtained with Th-C′ α-rays. E. FÜNFER (Ann. Physik, 1939, [v], 35, 147—152; cf. A., 1938, I, 381).—The measurements described previously have been extended to Be and B. Numerous sharp resonance levels narrower than 70 kv. are found, which are responsible for almost all the neutron yield, and are situated ~200 kv. apart.

L. J. J.

Groups of slow neutrons. E. AMALDI and E. FERMI (Ric. sci. Progr. tecn., 1936, [ii], 7, I, 310—

313; Chem. Zentr., 1936, ii, 3629—3630; cf. A., 1938, I, 427).—The "logarithmic width" of a neutron group is the mean no. of collisions undergone while in that group by a neutron the energy of which is reduced by a factor $1/e$ at each collision. This width has the following vals. for a mean free path (λ) of 0·65 cm.: group D, 0·8; A, 0·06; I, 0·2. The mean squared ranges r^2 (r in cm.), measured in H_2O, are: group C, 327; D, 277; A + B, 271; I, 262. The energies (W, W') of two groups are related to their ranges by log $(W/W') = (r^2 - r'^2)/6\lambda^2$. The energies of the D, A + B, and I groups are in the ratio 1 : 11 : 400. The difference of 50 in the r^2 vals. for the C and D groups is attributed to diffusion of the C-neutrons (24), and to the comparatively long slowing-down process in the energy interval between 1 e.v. and the energy of thermal motion.

A. J. E. W.

Absorption of neutrons of medium energy. J. H. E. GRIFFITHS (Proc. Roy. Soc., 1939, A, 170, 513—519).—Neutrons were produced by the action of γ-rays of Ra on Be and their absorption in 18 elements investigated by comparison of the activities of the artificially produced isotopes. The absorption coeff. of the β-rays was also found and the relative vals. of the neutron absorption cross-section were calc. The results are compared with theory and reasons for the large discrepancies are discussed.

G. D. P.

Neutrons from the break up of ⁵He. H. STAUB and W. E. STEPHENS (Physical Rev., 1939, [ii], 55, 845—850).—The energy spectrum of the neutrons from the disintegration of Li by 0·8-Me.v. deuterons was measured by the method of recoil particles in a high-pressure cloud chamber at different stopping powers. A sharp drop in the no.–energy curve at 3·8 Me.v. indicates the max. energy of the neutrons from the two-stage reaction ⁷Li + ²D → ⁴He + ⁵He + 14·3 Me.v. (1); ⁵He → ⁴He + ¹n + 0·8 Me.v. (2). By measuring the α-particle spectrum with an ionisation chamber–linear amplifier–counter, the relative no. of α-particles from (1) gave the relative probability of reaction (1) and hence (2) in good agreement with the observed relative no. of neutrons.

N. M. B.

Resonance scattering of protons by lithium. E. C. CREUTZ (Physical Rev., 1939, [ii], 55, 819—824; cf. Hafstad, A., 1936, 1313).—Curves for the scattering of protons by a thick target of Li in the energy range 272—586 e.kv., at an angle of 156°, show a max. at 458 e.kv., approximating to the energy for Li γ-ray resonance max. The scattering from a Be crystal increases smoothly with proton energy throughout the range. The anomaly indicates that the γ-radiation obtained by bombarding ⁷Li with 440-e.kv. protons arises from the reaction ⁷Li + ¹H → ⁸*Be; ⁸*Be → ⁸Be + γ, that the ⁸Be state is odd, and that there are no odd excited states of the α-particle below ~13 Me.v.

N. M. B.

Transformation of boron by slow neutrons with production of α-particles and protons. W. MAURER and J. B. FISK (Z. Physik, 1939, 112, 436—452).—The transition was examined in BCl_3 vapour in an ionisation chamber with about 40,000 single processes. Both α-particles and protons are

produced and ascribed to the processes $^{10}_{5}B$ (n, α) $^{7}_{3}Li$ and $^{10}_{5}B$ (n, p) $^{10}_{4}Bo$. The (n, α) transition gives rise to four or five energy groups, that of highest energy arising at 2·90 e.Mv. From the group separation of ^{7}Li, three or four excitation levels are derived at $E = 200, 410, 640$, and 840 e.kv.   L. G. G.

(A) **Nuclear isomerism in element 43.** G. T. SEABORG and E. SEGRÈ. (B) **Calibration of the ionisation chamber.** W. GENTNER and E. SEGRÈ (Physical Rev., 1939, [ii], **55**, 808—814, 814).—(A) A detailed account of results previously reported (cf. A., 1939, I, 3). The activity is of 6·6 hr. half-life; the energy of the decay electrons is 116 e.kv., and this line spectrum must be due to the conversion electrons of a highly converted γ-ray of energy 136 e.kv. due to a transition from an excited state of the 43 isotope. The observed X-rays are attributed to the $K\alpha$ line of 43; the emitted γ-rays are of ~180 e.kv. energy and aro interpreted as following the transition which gives rise to the conversion electrons.
(B) Practical details are reported.   N. M. B.

Nuclear excitation of indium with α-particles. K. LARK-HOROVITZ, J. R. RISSER, and R. N. SMITH (Physical Rev., 1939, [ii], **55**, 878; cf. Barnes, A., 1939, I, 173).—Bombardment of In with 16-Me.v. α-particles from a cyclotron for 30—90 min. gives rise to ^{115*}In (4 hr.) as in the case of neutron, proton, or X-ray excitation. Other weak activities were observed.   N. M. B.

Identification of some of the products of uranium cleavage. P. ABELSON (Physical Rev., 1939, [ii], **55**, 876—877).—The recently reported identifications ^{131}I (8 days) and ^{129}Te (70 min.) are confirmed (cf. A., 1939, I, 296). Further identifications are : ^{131}Te (30 hr.) and ^{131}Te (25 min.) $\rightarrow$ ^{131}I (8 days); ^{129}Sb (4·6 hr.) $\rightarrow$ ^{129}Te (70 min.); ^{127}Sb (82 hr.) $\rightarrow$ ^{127}Te (10 hr.).   N. M. B.

Time involved in the process of nuclear fission. N. FEATHER (Nature, 1939, **143**, 597—598).—Experiments affording evidence of asymmetry in the spatial distribution of the fission fragments of U bombarded by fast neutrons from Li + deuterons aro described. Tho activity collected through a given thickness of absorber in the direction of neutron motion is $>$ that in the reverse direction. The observed asymmetry shows that, after neutron capture, fission of the nucleus usually occurs before the original momentum of the system is lost. The mean life indicated for the intermediate nucleus is $\rightarrow$ ~5 × 10^{-13} sec., which is $\ll$ the max. life (3 × 10^{-3} sec.) indicated by the work of Green et al. (A., 1939, I, 234).   L. S. T.

New products of the fission of the thorium nucleus. L. MEITNER (Nature, 1939, **143**, 637; cf. A., 1939, I, 233).—Irradiation of a layer of Th oxide with neutrons from Li + 800-kv. deuterons, collection of the recoil nuclei in H_2O, and pptn. with H_2S gave a ppt. containing substances of half-life 40 min. and 14·5 hr. Thus, some of the fission products of Th show a chemical behaviour similar to that of " trans-U " elements, and essentially the same elements are produced in the fission of U and Th.   L. S. T.

Radioactive halogens produced by the neutron bombardment of uranium and thorium. R. W. DODSON and R. D. FOWLER (Physical Rev., 1939, [ii], **55**, 880; cf. Abelson, A., 1939, I, 234).—After bombardment of U and Th by D–D neutrons the I (2·5 hr.) was not found, but two I activities (~45 min. and 12 hr.) both from U and Th and a Br activity (~40 min.) from U are reported and chemical separations are described.   N. M. B.

Delayed neutron emission from uranium. E. T. BOOTH, J. R. DUNNING, and F. G. SLACK (Physical Rev., 1939, [ii], **55**, 876; cf. Roberts, A., 1939, I, 235).—The effect is produced primarily by slow neutrons and follows approx. the $1/v$ law. The decay curves are analysed into two periods of ~45 and 10—15 sec. The ratio of the initial no. of delayed neutrons per sec. to the total no. of U fissions per sec. was 1 : 60. The val. found for the U fission cross-section for slow neutrons was ~3 × 10^{-21} sq. cm., and hence the oross-section for delayed neutron emission is ~0·05 × 10^{-24} sq. cm. The decay curves for γ-rays emitted by U after neutron irradiation analyse into periods of 10—15 and 40—50 sec., together with some longer periods. Results indicate that some of the fission fragments emit β-rays with these periods and are then still sufficiently excited for the emission of γ-ray quanta, or occasional delayed neutrons.   N. M. B.

Search for β-particles emitted during uranium fission process. J. W. KENNEDY and G. T. SEABORG (Physical Rev., 1939, [ii], **55**, 877).—Two Geiger–Müller counters in a coincidence arrangement and separated by 1·3 cm. of Al were placed near 400 g. of U_3O_8 undergoing several thousand fissions per min. under irradiation by paraffin-slowed neutrons from a Ra–Be source. No effect was observed, indicating absence of high-energy β-particles. The emission of β-particles of lower energies simultaneously with the fission process does not occur during the majority of the fissions.   N. M. B.

Simple capture of thermal and resonance neutrons by uranium. H. VON HALBAN, jun., L. KOWARSKI, and P. SAVITCH (Compt. rend., 1939, **208**, 1396—1398).—The capture of thermal and resonance neutrons by U gives the β-active $^{239}_{92}U$. The effective section of U for thermal neutrons has been determined by comparison of the activity produced in U and in Au foil by the same source. Irradiation with and without a Cd screen gives the combined intensity for thermal and resonance neutrons and for resonance neutrons only. The magnitude of the resonance band of U is discussed.   W. R. A.

Energy of neutrons liberated during nuclear partition of uranium. M. DODÉ, H. VON HALBAN, jun., F. JOLIOT, and L. KOWARSKY (Compt. rend., 1939, **208**, 995—997).—The production of ^{32}P has been detected in CS_2 exposed to the action of U bombarded with photo-neutrons (Ra–Be source); this process requires neutrons of energy $\not< 2$ Me.v., which are shown to originate from the U and evidently result from partition of U nuclei.   A. J. E. W.

Neutrons emitted during bipartition of uranium under the action of neutrons. C.

MAGNAN (Compt. rend., 1939, 208, 1218—1220).— Very high ionisation (170,000 ion pairs per min.) is observed in an ionisation chamber containing a layer of U oxide (0·025 g. per sq. cm.) surrounded with paraffin and bombarded with neutrons from a source equiv. to 20 g. of Rn + Be. The intensity of the ionising particles, which penetrate 350 μ. of Al, increases by 40% on trebling the U oxide density. This effect can only be due to showers of ~50 protons with a range in air of 60 cm. and an energy of 7 Me.v., or to simultaneous production of ~500 neutrons. The occurrence of chain reactions (cf. Haenny and Rosenberg, A., 1939, I, 293) is suggested.
A. J. E. W.

Calculations relative to the eventual conditions of the chain transmutation of uranium. F. PERRIN (Compt. rend., 1939, 208, 1394—1396).— Mathematical. Calculations have been made for reactions produced by rapid neutrons. W. R. A.

Stopping power of mercury and of nitrogen for cosmic-ray electrons. J. H. BARTLETT, jun. (Physical Rev., 1939, [ii], 55, 803—807).—Mathematical. Form factors for N found with analytic wave functions and for Hg with a Hartree field differ considerably in the case of N and inappreciably in the case of Hg from those found with a Fermi–Thomas field. The formula for the cross-section for impact radiation due to high-energy electrons is revised.
N. M. B.

Cosmic-ray particles at great depth. J. BARNÓTHY and M. FORRÓ (Physical Rev., 1939, [ii], 55, 870—872; cf. Wilson, A., 1939, I, 175).— Absorption curves for cosmic rays at 980 m. H$_2$O-equiv. depth with two- and three-fold coincidence counters and various dispositions of different thicknesses of Pb are given and discussed. N. M. B.

Range of nuclear forces and the process of disintegration by ultra-radiation. E. BAGGE (Ann. Physik, 1939, [v], 35, 118—134).—The range and intensity of intra-nuclear forces are calc. from the velocity distribution of secondary particles produced by impact of fast protons and neutrons, giving respectively $0·8r_0 \pm 0·1r_0$ for the range, where $r_0 = e^2/mc^2$, and 35·7 Me.v. for the force const. in the Gaussian exponential equation. The ultra-radiation must contain >200 times as many neutrons as protons. L. J. J.

Absorption of cosmic particles in small thicknesses of lead and copper. A. GANDIN (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 220—222; Chem. Zentr., 1936, ii, 3632).—Coincidence counter measurements with >40 g. per sq. cm. Pb-equiv. show that equal absorption occurs in equal superficial masses of Pb and Cu. Soft particles are absorbed in screens equiv. to 0·3 cm. of Pb. A. J. E. W.

Secondary effects of cosmic rays in lead. (MME.) T. GRIVET-MEYER (Compt. rend., 1939, 208, 1216—1218).—Showers produced in Pb screens of different thicknesses have been studied with quadruple and triple coincidence counters. At ground level a Rossi curve is obtained, a sharp max. at 22 mm. of Pb showing the occurrence of electrons of energy 5—6 × 10^8 e.v., which probably result from decomp.

of mesotrons. At a depth equiv. to 30 m. of H$_2$O this high-energy component disappears; a less pronounced max. occurring at 12 mm. of Pb (energy ~ 1·5 × 10^8 e.v.) is attributed to a transition effect. At a depth equiv. to 75 m. of H$_2$O no max. is obtained, triple and quadruple coincidences reaching a saturation val. at 5—6 mm. of Pb (energies <7 × 10^7 e.v.). The no. of secondary particles produced by each penetrating ray increases below ground level.
A. J. E. W.

Diurnal and sidereal effects and the meteorologic influences on shower and vertical intensity of cosmic rays. J. BARNÓTHY and M. FORRÓ (Physical Rev., 1939, [ii], 55, 868—870).—A tabulation and review of collected data. N. M. B.

Rapid and slow mesotrons in cosmic radiation. W. BOTHE (Naturwiss., 1939, 27, 305—312).—The nature of cosmic ray showers is discussed and the evidence in favour of the existence of mesotrons is reviewed. The theory of mesotron showers, and other processes involving mesotrons, e.g., the conversion of an uncharged into a charged mesotron, and vice versa, the combination of a mesotron with a neutron to give a proton, and with a proton to give a neutron, and the spontaneous disintegration of mesotrons, are also discussed. Explosion showers are mentioned. A. J. M.

Secondary radiation produced by the penetrating component of the cosmic rays. G. FRANK-KAMENETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, 21, 168—171).—After filtering out the soft primary radiation by means of Pb screens, the intensity of the soft secondary radiation, which is in equilibrium with the penetrating component, has been measured for different absorbents. The equilibrium intensity of the secondary radiation is essentially higher in light substances than in heavy ones. E. S. H.

Classification of atomic masses. A. JAQUEROD (Helv. Phys. Acta, 1936, 9, 339—340; Chem. Zentr., 1936, ii, 1487).—The author's relationship between mass defect (Δm) and mass no. (n) (cf. A., 1934, 578) is further considered. The elements fall into three groups ($n = 1$—64, 65—208, >208); in the second group a pronounced periodicity of 4 in the n vals. is observed, corresponding with the high stability of the α-particle. Elements with $n = 4m$ lie on a hyperbola which is symmetrical about the Δm axis, other elements lying on its asymptotes.
A. J. E. W.

Relation of particle masses in the nuclear structure of the atom. At. wt. formula. M. HEGEDUŠIĆ (Almanaha Savre. Probl., 1936, 3, 17 pp.; Chem. Zentr., 1936, ii, 2853—2854).—Relationships between the total no. of nuclear particles (N) and the nos. of protons (Z) and neutrons (n) are considered in relation to A. $A = \alpha N + (n - Z)f + B$ [α = at. wt. of fundamental particle (0·9967); f = at. wt. of a photon (0·00108)]. The term B, representing α-, β-, and γ-emission, is = $0·0202Z^i + (3·1 \times 10^{-5})n^2$. A. J. E. W.

Nuclear packing effects. A. H. W. ATEN, jun. (Physica, 1939, 6, 425—434).—The surface

energy calc. for a static close-packed proton–neutron nuclear model is in agreement with experimental data for heavy nuclei. Attractive forces between protons do not contribute significantly to the energy of large nuclei. L. J. J.

Nuclear and magnetic moments by the α-particle method. R. G. SACHS (Physical Rev., 1939, [ii], **55**, 825—832).—Mathematical calculations for light nuclei are reported. Some ambiguities in comparison with results based on the Hartree model are found. N. M. B.

Mass of the first photon. L. LABOCCETTA (Ric. sci. Progr. tecn., 1936, [ii], **7**, II, 207—209; Chem. Zentr., 1936, ii, 3758).—Theoretical. The energy of the first photon is equiv. to that of a particle of mass μ and velocity c. $\mu = m/N^2$ (N = Eddington's no.) = 4.935×10^{-32} g. A. J. E. W.

Influence of atomic electrons on radiation and pair production. J. A. WHEELER and W. E. LAMB, jun. (Physical Rev., 1939, [ii], **55**, 858—862).—Mathematical. N. M. B.

Determination of ionisation coefficients α and γ in gases. A. GOSSERIES (Physica, 1939, **6**, 458—472).—The calculation is simplified by the transformation of Townsend's formula described. A method of compensating for variations in intensity of ultra-violet illumination (as a source of ions) is given. L. J. J.

Theory of radiation. G. A. SCHOTT (Proc. Roy. Soc., 1939, **A**, **171**, 1—26).—An attempt is made to account for the observed properties of radiation by classical electro-dynamics. The properties considered are the line character of spectra, the Planck–Einstein law ($E = h\nu$), the possibility of interference over long distances, and the capability of ionising atoms or mols. The existence of radiationless orbits is assumed and the frequency of the radiation emitted is found to depend on the time of transit from one stationary state to another. Qual. agreement with the facts is obtained. G. D. P.

Comprehensive fundamental electrical formula. (A) W. F. DUNTON. (B) C. V. DRYSDALE (Nature, 1939, **143**, 601; cf. A., 1938, I, 491; A., 1939, 1, 63). L. S. T.

Calculation of the eigen-function and energy of the ground state of the valency electron in alkali atoms. P. GOMBÁS (Ann. Physik, 1939, [v], **35**, 65—72; cf. A., 1939, I, 118).—The method previously developed is applied to K and Rb. O. D. S.

Wefelmeier's model of trans-uranium. (A, C) F. J. VON WISNIEWSKI. (B, D) C. F. VON WEIZSÄCKER (Naturwiss., 1939, **27**, 277, 277—278, 278, 278).—(A) In connexion with Weizsäcker's comments (A., 1939, 1, 237) on the Wefelmeier model of trans-U it is pointed out that an ellipsoid cannot be an equilibrium for surface potential.
(B)—(D) Polemical. A. J. M.

Theory of mesons and nuclear forces. E. C. G. STUECKELBERG (Nature, 1939, **143**, 560—561).—The statement of Møller *et al.* (A., 1939, I, 237) does not correspond with the author's results (A., 1938, I, 490). L. S. T.

Material radiation in the emission from a hot cathode. W. REICHELT (Physikal. Z., 1939, **40**, 387).—In the investigation of cathodic sputtering it was found that at the place of collision of the rays the metal becomes raised with respect to the surrounding metal. This is ascribed to the presence of a material radiation accompanying the cathode rays. A. J. M.

New lines in the rock-salt prismatic solar spectrum. A. ADEL (Astrophys. J., 1939, **89**, 320; cf. A., 1939, I, 59, 239).—Telluric lines previously unknown and probably due mainly to absorption by H_2O vapour range in position from the H_2O band at 6·3 μ. to the limit of atm. transmission. L. S. T.

Colour centres in potassium chloride crystals with small additions of alkaline-earth chlorides. H. PICK (Ann. Physik., 1939, [v], **35**, 73—83).—The absorption spectra of KCl colour-centre crystals containing small amounts of $CaCl_2$, $SrCl_2$, and $BaCl_2$ have been investigated. Crystals chilled from 250° to room temp. show the F and F' bands as in pure KCl. After suitable thermal and optical treatment three new bands were observed between two of which reversible interchange takes place as between the F and F' bands. At. models are described for the new types of centre corresponding with these bands. O. D. S.

Formation of colour centres in potassium iodide crystals. R. VOSSNACK (Ann. Physik, 1939, [v], **35**, 107—117).—The heat of dissolution of K atoms in KI crystals determined from the temp.-dependence of [K] in crystals exposed to K vapour in a flowing system is 0·11 e.v., whereas data obtained in static systems give 0·18 e.v. The discrepancy is due to absorption of K by the walls of the vessel in the static system. The electrical method described permits [K] in the crystal $> 5 \times 10^{17}$ atoms per c.c., the max. for the optical method, to be measured. L. J. J.

Band spectra of the copper halides. E. ROSA (Nuovo Cim., 1936, **13**, 214—219; Chem. Zentr., 1936, ii, 3636).—The intensities of the A and B band systems in the arc spectra of CuCl, CuBr, and CuI are increased by reduction of pressure (10—76 cm.) or temp., the higher-energy levels containing fewer excited atoms at low pressures. Flame spectra confirm this conclusion. A. J. E. W.

Application of the Franck–Condon principle to the absorption spectrum of mercuric chloride. H. SPONER and E. TELLER (J. Chem. Physics, 1939, **7**, 382).—Certain modifications of Wehrli's interpretation (A., 1938, 1, 10, 432) are discussed which bring experimental data into complete agreement with theory. W. R. A.

Visible fluorescence spectrum of HgCl and the heat of formation of gaseous mercuric chloride. K. WIELAND (Z. physikal. Chem., 1939, **B**, **42**, 422—431).—The complicated emission spectrum of HgCl (5600—3100 A.) has been considerably simplified by excitation of fluorescence, particularly by addition of foreign gases, and a vibrational analysis has been

made. A formula applicable to some 200 bands is given. The dissociation energy is 26 kg.-cal. for the ground state of HgCl. From the fluorescence data and the heat of decomp. of $HgCl_2$ into HgCl and Cl, the heat of formation of $HgCl_2$ is calc. as 103 ± 5 kg.-cal., in good agreement with the thermochemical val. of $104\cdot5\pm0\cdot5$ kg.-cal.   W. R. A.

Magnetic rotation spectra of sulphur dioxide and carbon disulphide in the ultra-violet. P. KUSCH and F. W. LOOMIS (Physical Rev., 1939, [ii], **55**, 850—857).—Using a H_2O-cooled H_2 discharge tube and a quartz spectrograph, magnetic rotation spectra were photographed. CS_2 gives an intense spectrum at 3355—3640 A., and a weaker one at 3125—3250 A. SO_2 gives a spectrum at 2939—3164 A. Microphotometer records are given and frequencies, intensities, directions of rotation, and the frequencies of the corresponding heads measured in absorption are tabulated. The magnetic rotation spectra are not sufficiently extensive to enable analyses to be made. Reference to spectra of other substances confirms the conclusion that little help in the analysis of complicated absorption spectra of polyat. mols. can be obtained from magnetic rotation spectra. N.M.B.

Magnetic evidence regarding the state of manganese in glasses. S. S. BHATNAGAR (Nature, 1939, **143**, 599—600).—In Mn–borax glasses, the Mn ions in the decolorised samples have a val. of $268\cdot3 \times 10^{-6}$ for χ, in agreement with $269\cdot3 \times 10^{-6}$ for $Mn^{\cdot\cdot}$. Coloured samples have a val. intermediate between those of $Mn^{\cdot\cdot}$ and $Mn^{\cdot\cdot\cdot}$. On exposure to ultra-violet light with a Wood filter, the decolorised glass only gives a fluorescence (orange-red), which resembles that of the anhyd. Mn halides. Coloured phosphate glasses are non-fluorescent, but the decolorised samples fluoresce with an orange-red glow, indicating $Mn^{\cdot\cdot}$ in the reduced glass.   L. S. T.

Intensities of electronic transitions in molecular spectra. IV. Cyclic dienes and hyperconjugation. V. Benzene. VI. Molecular refractivities of organic compounds. VII. Conjugated polyenes and carotenoids. R. S. MULLIKEN (J. Chem. Physics, 1939, **7**, 339—352, 353—356, 356—363, 364—373; cf. A., 1939, I, 177).—IV. The departure of the spectra of *cyclo*pentadiene and $\Delta^{1:3}$-*cyclo*hexadiene from the spectra of open-chain conjugated dienes is due to " hyperconjugation "; this is classified as (a) first-order (conjugation between a double or triple linking and a saturated group), and (b) second-order (between 2 saturated groups), of which (a) is of major importance. Hyperconjugation is usually restricted to excited states, and, while accounting for the displacement of spectra to longer $\lambda\lambda$, and corresponding effects in the refractivities when C_2H_2, C_6H_6, and butadiene (and other compounds containing double linkings) are alkyl-substituted, it cannot account completely for the decreasing heat of halogenation of these compounds on alkyl substitution (dependent on the energies of mols. in their normal states). Hyperconjugation may assist in restricting free rotation of groups by slightly shortening C—C distances. The spectra of thiophen, furan, and pyrrole are also considered.

V. Conjugation of the 3 double linkings is strong in

B B* (A., I.)

C_6H_6 owing to conditions favourable to resonance. The high symmetry of the mol. allows only one $N \to V$ transition. Therefore the $N \to V$ absorption region at ~2000 A. should be stronger than for a mol. with 3 unconjugated double linkings. The relations of the spectra of C_5H_5N and of C_6H_6 derivatives to that of C_6H_6 are considered.

VI. The partial refractivities for the unsaturation electrons in open-chain (A) and cyclic dienes [particularly conjugated dienes (B)] and C_6H_6 have been approx. calc. The observed exaltations of the refractivity and dispersion in (A) are explained qualitatively and semi-quantitatively, and the explanation is further applicable to exaltations in other conjugated systems (e.g., with conjugated triple linkings or with conjugation of C:O and C:C bonds). Refractivity data on unconjugated alkenes and dienes and (B) are also in harmony with the theory. Exaltation in substituted butadienes, benzenes, and styrenes is attributed to hyperconjugation (see IV).

VII. Theoretical calculations on various models of butadiene, octatetraene, and β-carotene show that for each the unsaturation electrons give rise to a series of $N \to V$ transitions which spread over an increasing range of the absorption spectrum with increase in the no. of conjugated double linkings. The greater part of the $N \to V$ intensity should be conc. in its longest-λ member $N \to V_1$, the intensity of which should increase as it shifts towards longer $\lambda\lambda$ with increase in double linkings. This behaviour is observed in the absorption spectra of conjugated polyenes and their derivatives. This leads to a theoretical explanation of the existence of strong colour in the carotenoids. Tho relation between absorption $(N \to V_1)$ and fluorescence $(V_1 \to N)$ spectra is discussed, and the gap between the longest-λ absorption band and the shortest-λ fluorescence band is explained. Theory indicates that the shape of the mol. affects strongly distribution of intensity and the total intensity in the $N \to V$ spectrum; the more elongated is the mol., the greater are the total intensity and the concn. of intensity in the $N \to V_1$ transition. This is illustrated with reference to α-furylpolyene aldehydes and acids. The $N \to V_1$ transitions in conjugated polyenes and their derivatives should be polarised approx. along the long axis of the mol., giving rise to a high polarisability in that direction. This may explain their reactivity and, especially, their tendency to polymerise.   W. R. A.

Absorption spectra by the Hartley–Baly method of several hydrocarbons of condensed benzene nuclei : anthracene, pyrene, naphthacene, perylene. P. POGÂNGEANU (Bull. Acad. Sci. Roumaine, 1938, **20**, 24—28).—The absorption spectra of anthracene, pyrene, and naphthacene in EtOH solution, and perylene (I) in both EtOH and n-C_7H_{16} solution, have been examined from 6000 to 2100 A. For each substance 4 concns. (10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6}N.) and 15 thicknesses (between 10 and 100 mm.) were used. The absorption curves and the $\lambda\lambda$ of the absorption max. are given. The spectra of (I) in EtOH and n-C_7H_{16} are similar but the absorption max. are displaced to longer $\lambda\lambda$ in the latter solvent.   W. R. A.

Absorption spectra of salicylic acid and its alkali-metal salts in aqueous solution. C. S. PIAW (Compt. rend., 1939, **208**, 1292—1294).—λλ of the max. (2953—3006) and min. (2572—2602 A.) of the A-band are given for the acid and its Li, Na, and K salts; the position of this band shows no regular variation with the mol. wt., but it is displaced to higher λλ with increasing concn. The acid gives a second band (B, max. 2352 A.) which is attributed to the carboxylic OH group, as it disappears at high dilutions. The Li salt probably gives a weak B-band (max. 2284 A). A. J. E. W.

Ultra-violet absorption spectra of acridine, ethyl-, pentadecyl-, and phenyl-acridine. G. A. DIMA and P. POGÂNGEANU (Bull. Acad. Sci. Roumaine, 1939, **21**, 38—40).—Data are recorded for solutions in EtOH between 3880—2500 A. L. J .J.

Absorption spectra of organic substances in concentrated sulphuric acid. V. Compounds containing condensed carbon rings. F. BANDOW (Biochem. Z., 1939, **301**, 37—57; cf. A., 1939, I, 57).—Curves are given for polycyclic hydrocarbons (including carcinogenic hydrocarbons), sex hormones, sterols, and bile acids. In some cases H_2SO_4 is less suitable than other solvents. The spectra are of use in the detection of biologically important substances. W. McC.

Recent progress in the interpretation of molecular spectra and in the study of molecular spectra in celestial objects. I. Intensities of electronic transitions in molecular spectra. R. S. MULLIKEN. **II. Forbidden transitions in diatomic molecules.** G. HERZBERG. **III. Dissociation, predissociation, and recombination of diatomic molecules.** G HERZBERG. **IV. Infra-red spectrum of water vapour.** D. M. DENNISON. **V. Influence of pressure and temperature on the absorption and fluorescence of spectral lines.** H. BEUTLER. **VI. Continuous spectra.** G. H. SHORTLEY. **VII. Electron affinity in astrophysics.** R. WILDT. **VIII. Molecular bands in stellar spectra.** N. T. BOBROVNIKOFF. **IX. Molecular bands as indicators of stellar temperatures and luminosities.** W. W. MORGAN. **X. Spectroscopic studies of planetary atmospheres.** A. ADEL. **XI. Interpretation of the spectra of comets and their forms.** K. WURM (Astrophys. J., 1939, **89**, 283—288, 288—289, 290—292, 292—294, 294, 295, 295—301, 301—310, 310—311, 311—312, 312—319).—A symposium. L. S. T.

Infra-red absorption spectra of solids by the powder method. (Acetates, formates, oxalates, acetylacetonates, sulphates.) J. LECOMTE and R. FREYMANN (Compt. rend., 1939, **208**, 1401—1403). —A method of examining thin layers of finely powdered solids deposited on rock-salt or KBr is outlined. It is capable of being employed with many different types of solids, those which decompose on fusion, H_2O-sol. and H_2O-insol. solids, and solids containing H_2O of crystallisation. Data are given for AcOH and 11 metallic acetates, 3 metallic formates, $H_2C_2O_4,2H_2O$ and 4 metallic oxalates, 3 metallic acetylacetonates, and $CuSO_4$ (anhyd. and $5H_2O$). W. R. A.

Infra-red absorption of the phenylmethanes. F. T. WALL and G. W. McMILLAN (J. Amer. Chem. Soc., 1939, **61**, 1053—1055).—Using a grating spectroscope and CCl_4 solutions (0·1M.) and a cell length of 0·325 cm., the absorption spectra of C_6H_6, PhMe, CH_2Ph_2, $CHPh_3$, and CPh_4 (saturated solution and 2 cm. thickness) have been determined from 3·2 to 3·6 μ. All compounds containing aliphatic CH exhibit one or more (= no. of aliphatic H) bands >3·35 μ.; each compound gives a triplet band near 3·25 μ. which is attributed to aromatic CH vibrations. Results for individual mols. are discussed and force consts. have been calc. for C·H bonds. W. R. A.

Infra-red and Raman spectra of polyatomic molecules. VII. Hexadeuteroethane. F. STITT. **VIII. Dimethyl ether.** B. L. CRAWFORD, jun., and (MISS) L. JOYCE (J. Chem. Physics, 1939, **7**, 297—307; 307—310).—C_2D_6 (approx. 97%) was prepared by catalytic deuteration at 100° of C_2D_2, using a Pt catalyst and a ratio of D_2 to C_2D_2 of 10 : 1. A sample of acetylene, prepared by passing D_2O vapour over NaC_2H, formed by passing C_2H_2 through a solution of Na in liquid NH_3, contained 47·3% C_2D_2, 43% C_2DH, and 9·6% C_2H_2 and yielded a mixture of C_2D_6, C_2D_5H, and $C_2D_4H_2$ (I) on catalytic deuteration. The infra-red absorption spectra of C_2D_6 and of (I) have been investigated from 2 to 22 μ.; bands due to C_2D_6 are easily identifiable since those due to the partly deuterated mols. show enhanced absorption in the spectrum of (I). The Raman spectrum of liquid C_2D_6 at —80° and the polarisation of the lines have been investigated. Vibrational analyses are made for the two probable symmetries of the equilibrium configuration, D_{3d} (staggered) and D_{3h} (eclipsed). Assignments of fundamental ѡ are made by consideration of (i) selection rules, shape of band envelopes, and polarisation of Raman lines, (ii) calc. vals. of ѡ obtained using the potential function of C_2D_6, (iii) the product rule relating the ѡ of isotopic analogues of identical symmetry, and (iv) agreement between calc. and observed heat capacities. The spectroscopic data can be interpreted by assuming either of the two configurations. The vibrational potential functions of C_2H_6 and C_2D_6 are discussed. The analyses of the C_2H_6 vibration spectrum by Crawford et al. (A., 1939, I, 8) and by Karweil and Schäfer (A., 1938, I, 494) are considered and amended.

VIII. The infra-red absorption spectrum of gaseous Me_2O has been investigated from 2 to 22 μ. and results, in conjunction with available data on Raman spectra, are discussed. Types of vibration and their spectroscopic activities are given and tentative assignments of fundamental ѡ are made. W. R. A.

Scattering of light by large water drops. I, II. G. R. PARANJPE, Y. G. NAIK, and P. B. VAIDYA (Proc. Indian Acad. Sci., 1939, **9**, A, 333—351; 352—364).—On the basis of the theory of Mie (Ann. Physik, 1908, **25**, 428) intensity and polarisation of light-scattering have been calc. for large H_2O drops (radius 0·4—3 μ.).

II. The variation of the intensity of scattered light with the angle of scattering has been determined for H_2O drops of radii 1·096, 2·19, and 3·28 μ. The data

agree with theoretical vals. and indicate that the theory of Mie applies to particles of any size.

W. R. A.

Raman effect of concentrated electrolytic solutions. A. DA SILVEIRA (J. Chem. Physics, 1939, **7**, 380—381).—The Raman spectra at 15° of conc. aq. solutions of $ZnCl_2$, $Zn(NO_3)_2$, $ZnSO_4$, $Zn(ClO_4)_2$, and $Cu(NO_3)_2$ are recorded and discussed.

W. R. A.

Influence of temperature on the Raman spectrum of ammonium nitrate and sulphate. H. VOLKRINGER, (MME.) M. FREYMANN, and R. FREYMANN (Compt. rend., 1939, **208**, 1005—1008).—Raman vv due to the NH_4 group in anhyd. NH_4NO_3 are as follows : —192°, 3050 (symmetric vibration, v_1), 3116, 3188, 3220 (v_2, triply degenerate) ; —75° to —20°, 3062, 3121, 3208 (doublet ?) ; 15°, 3135, 3220 ; >32°, ~3156 cm.$^{-1}$ $(NH_4)_2SO_4$ gives the following vv : —192°, 3027, 3126 (?), 3195, 3297 ; 15°, ~3145 cm.$^{-1}$ The NH_4 valency vv (700—1500 cm.$^{-1}$) given by NH_4NO_3 do not change with temp.

A. J. E. W.

Raman spectrum of neutral molybdates in the crystalline state and in aqueous solution. E. DARMOIS and (MLLE.) M. THÉODORESCO (Compt. rend., 1939, **208**, 1308—1309).—The spectrum of cryst. $Na_2MoO_4,2H_2O$ [897, 833 (doublet) ; 316 cm.$^{-1}$] corresponds with that of the aq. solution (cf. A., 1938, 1, 296). That of aq. K_2MoO_4 is similar (894, 839 ; 316 cm.$^{-1}$), but in the cryst. anhyd. salt the diffuse 839 cm.$^{-1}$ line is apparently resolved, giving a sharp triplet (887, 851, 821 ; 313 cm.$^{-1}$). The spectra are attributed to the MoO_4'' ion, which probably has a tetrahedral configuration in the anhyd. salts. The assumption of an octahedral dihydrated ion (A., 1938, I, 555) is unjustified.

A. J. E. W.

Raman spectra of co-ordination compounds. B. ROY (Indian J. Physics, 1939, **13**, 13—26).—Raman spectra of aq. [Pt en₃]Cl₄ (I) and aq. [Pt en₂]Cl₂ (II) have been investigated. Results are in disagreement with those of Mathieu (cf. A., 1937, I, 219, 394). Certain vv are assigned to [Pt en₃] and [Pt en₂], and the bearing of the results on the structure of these compounds and on the prediction of quantum theory on the nature of their co-ordination bonds is discussed.

W. R. A.

Raman effect of difluoromethane. G. GLOCKLER and G. R. LEADER (J. Chem. Physics, 1939, **7**, 382).—Liquid CH_2F_2 at ~ —60° gives 10 Raman lines.

W. R. A.

Raman effect : characteristic frequency of the ethylenic linking. A. KIRRMANN (Bull. Soc. chim., 1939, [v], **6**, 841—848 ; cf. A., 1939, I, 179).—Raman frequencies are recorded for $CMe_2:CH_2$, CHMe:CHBr, $CH_2:CMeBr$, $CH_2:CCl·CH_2Cl$ (b.p. 94°), CHBr:CH·CH₂Br, CHClBr·CH₂Br (b.p. 48°/12 mm., 163°/760 mm., d^{19} 2·248, n^{19} 1·554), $CH_2:CClBr$, and $CMe_2(OEt)_2$ (b.p. 113—114°, d^{19} 0·828, n_D^{19} 1·389). By correlating the results with previous data it is concluded that the additivity rules are obeyed to ±5 cm.$^{-1}$ by *trans*-compounds of the form CHR:CHR', but that the decrease in frequency for *cis*-compounds is not const. In derivatives of the form $CH_2:CRR'$ the additivity rules break down completely.

J. W. S.

Molecular association in formic and benzoic acids. P. KOTESWARAM (Z. Physik, 1939, **112**, 395—406).—The Raman spectrum of HCO_2H in H_2O exhibits a shift of the max. of the C:O band towards higher v with decrease in concn. and increase in temp. With BzOH the C:O frequency is higher in aq. solution than in C_6H_6 sol. or in the fused state. The association complexes present in the pure liquid materials are broken down to lower polymerides by heat and by dissolution in polar solvents. The change in v with HCO_2H is not ascribable to hydrate formation.

L. G. G.

Decay of willemite and zinc sulphide phosphors. R. P. JOHNSON (Physical Rev., 1939, [ii], **55**, 881 ; cf. Ramberg, A., 1939, I, 241).—Full tabulated data for the decay rates of willemite, other silicates, and various sulphides after excitation by ultra-violet light indicate that the silicates decay according to an exponential law and the sulphides to a bimol. law.

N. M. B.

Saturation effects in short-duration photoluminescence of zinc sulphide phosphors. W. DE GROOT (Physica, 1939, **6**, 393—400).—ZnS–Cu, ZnS–MnS, ZnS–Ag, and ZnS–CdS–Ag phosphors, but not U-glass, fluorescein, or $K_2UO_2(SO_4)_2,2H_2O$, show a decrease in intensity of fluorescence with increasing intensity of illumination (3300—3800 A.) and const. total illumination. The decrease is ~5—10% at 5 w. per sq. cm. Further measurements of the absorption coeff. of single crystals of ZnS and ZnS–CdS give lower vals. than those previously estimated (cf. A., 1939, I, 241).

L. J. J.

Breakdown of zinc sulphide by α-rays. E. STRECK (Ann. Physik, 1939, [v], **35**, 58—64 ; cf. A., 1939, I, 58).—The decomp. of Ra-containing ZnS–Cu phosphors has been investigated. About 1.75×10^4 Zn atoms are liberated and about 1.5×10^2 active centres destroyed for each α-particle emitted. About 10% of the α-particle energy is absorbed in the production of Zn atoms. The changes after breakdown in the light-sensitivity and in the velocity of decay of luminescence depend on the method of prep. of the phosphor.

O. D. S.

Characteristics of silicate phosphors. G. R. FONDA (J. Physical Chem., 1939, **43**, 561—577).—The fluorescence of Zn silicate phosphors, prepared either by heating a mixture of ZnO, MnO, and SiO_2 or by converting a solution of $Zn(NO_3)_2$ and $Mn(NO_3)_2$ in $Si(OEt)_4$ into a colloidal gel which is subsequently denitrated, is dependent on the presence of Mn, the optimum concn. being 0·4% of Mn at all temp. examined. The speed of reaction between ZnO, MnO, and SiO_2 is increased by the addition of KCl, NaCl, $ZnCl_2$, or $CdCl_2$ which can dissolve the silicate formed on the oxide particles. The reaction is a diffusion phenomenon with a heat of diffusion of 20—24 kg.-cal. Fluorescence is only slightly reduced as the silicate is diluted with excess of SiO_2, max. fluorescence corresponding with Zn_2SiO_4. X-Ray examination shows that Mn enters into the silicate structure. Conversion of the silicate into glass destroys its fluorescence on account of decomp.

C. R. H.

Photogenic effect and electronic activation of the N:N radical. R. AUDUBERT and R. RALEA (Compt. rend., 1939, **208**, 983—985).—Radiation is emitted during pyrolysis of N_3I, but not with NI_3 or NI_3,NH_3, showing that the N_3 group involves an activated N:N radical which emits photons on reversion to its normal state.   A. J. E. W.

Photo-electric effect and photo-electric conductivity in semi-conductor crystals. G. ATHANASIU (Bull. Soc. roum. Phys., 1934, **36**, 39—50; Chem. Zentr., 1936, ii, 1851).—The photo- and conductivity electrons differ only in their position of origin with respect to the electrodes; this explains a parallelism between the photo-electric effect at normal temp. and the conductivity at low temp. (cf. A., 1934, 474).   A. J. E. W.

Spectral sensitivity distribution in selenium barrier-layer cells. P. GÖRLICH (Z. Physik, 1939, **112**, 490—500).—The spectral sensitivity of various Se cells is measured and compared with existing data. Cells with a light-sensitive Cd–Se layer show a max. at 5400 A., in contrast to the ordinary Se cell where the max. lies between 5600 and 5900 A. By embedding Cd " disturbance centres " in the Se layer a new max. at 7100 A. is obtained.   L. G. G.

Theory of crystal rectifiers. N. F. MOTT (Proc. Roy. Soc., 1939, **A, 171**, 27—38).—The rectifiers considered are of the Cu_2O type; it is suggested that they consist of a layer of metal in intimate contact with a crystal which would be an insulator in the absence of impurity levels. A layer adjacent to the metal, about 10^{-4} cm. thick, is supposed to contain no impurity. The electrons are carried over the insulating barrier by thermal excitation. The theory is in agreement with experiment. It is pointed out that existing theories of the action of crystal rectifiers give rectification in the direction opposite to that observed.   G. D. P.

Electronic breakdown in solid dielectrics. A. E. W. AUSTEN and W. HACKETT (Nature, 1939, **143**, 637—638).—In agreement with Fröhlich's theory of the electronic breakdown of ionic crystals under electric stress (A., 1937, I, 444), the electric strength of polar crystals, e.g., KBr, can be calc. from the optical properties, ϵ, and mol. vol. Further, the electric strength of thin sheets of insulating material, e.g., mica, increases with a decrease in thickness when thickness is $\sim 10^{-5}$—10^{-6} cm., and with a rise in temp. up to a crit. val., which, for mica, is $\sim 400°$ K.   L. S. T.

Movement of electrons in homogeneous electric and magnetic fields. F. M. PENNING (Nederl. Tijds. Natuurk., 1936, **3**, 141—154; Chem. Zentr., 1936, ii, 1849).—The movement of electrons in an electric field between parallel plates and a superimposed magnetic field at a small angle ϕ to the plates is considered theoretically. The breakdown voltage can be varied by changing ϕ.   A. J. E. W.

New phenomenon of an electrical nature. G. PICCARDI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 84—85; cf. A., 1938, I, 604).—Further experiments are described which show that the activation of H_2O by contact with an electrostatically charged dielectric is not dependent on the nature of the latter.   O. J. W.

Thermal instability of dielectrics for alternating voltages when the loss angle is dependent on the field strength. A. GEMANT and S. WHITEHEAD (Phil. Mag., 1939, [vii], **27**, 582—595).—The theory of the thermal instability of dielectrics has been extended to include alternating voltages with a conductivity dependent on the field strength. The field is assumed to be determined by the distribution of the dielectric const. only and this varies with temp. Derived formulæ are illustrated by application to some experimental data. The limitations of the theory and the extensions required in practice are discussed.   W. R. A.

Dielectric constant of ammonium sulphate in the neighbourhood of the λ-point. R. GUILLIEN (Compt. rend., 1939, **208**, 980—981).—The dielectric const. ϵ' and the electric absorption ϵ'' have pronounced max. at the λ transition temp., $-53.4°$. c_p is also max. at this temp. The sudden rise of ϵ' below $-40°$ and the occurrence of high ϵ'' vals. below $-53.4°$ are incompatible with Pauling's hypothesis (A., 1930, 1357).   A. J. E. W.

Radius, action, and mobility of the polar OH group in alcohols. K. L. WOLF (Z. physikal. Chem., 1939, **B, 43**, 20—24).—Data are given to illustrate which characteristics must be considered in the evaluation of dielectric properties of alcohols.   W. R. A.

Dielectric constants of solid acetylene tetrachloride, ethylene dichloride, and ethylene chlorobromide. M. KUBO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 462—465).—The dielectric consts. of the above substances were determined over the temp. range $-100°$ to $50°$ for two frequencies (3×10^6 and 5.48×10^3 per sec.). For $(CHCl_2)_2$ contribution of the dipole to the dielectric const. is not observable in the solid state, the crystal forces being powerful enough to prevent orientation. The val. of ϵ for liquid $C_2H_4Cl_2$ is in good agreement with earlier determinations, but for the solid near the m.p. the val. is $>$ that found by Smyth et al. (A., 1933, 209). There is no discontinuity in the ϵ–temp. curve corresponding with the transition at $-65°$ suggested by observation of the Raman effect and the cooling curve. The behaviour of $CH_2Cl\cdot CH_2Br$ is similar to that of $(CH_2Cl)_2$ and no transition can be detected. The mean mol. state in the solid is the trans-position in which the mol. is practically non-polar.   A. J. M.

Molecular configuration of diphenyl ether by dipole moment data. K. HIGASI and S. UYEO (Bull. Chem. Soc. Japan, 1939, **14**, 87—101).—The moments of 2 : 2'-dinitro-, 2 : 2'-di-iodo-, and 2 : 2'-dimethyl-diphenyl ether in C_6H_6 and in C_6H_{14} at 27° and 50° are 6.64, 2.72, and 0.83 D., respectively. Those of the 3 : 3'-, 3 : 4'-, 3 : 4, and 4 : 4'-Me₂ derivatives are 1.40, 1.42, 1.53, and 1.46 D., respectively, in C_6H_6 at 30°. Assuming vals. for the O valency angle and the O·C and C·X bond moments, both the Pauling structure (C_6H_6 rings coplanar with the O valencies) and the Smyth structure (rings perpendicular to the plane of these valencies) are shown to be improbable.

A structure in which the rings are perpendicular to each other gives much better agreement with experiment.   T. H. G.

Solid state of H_2, HD, and D_2. M. E. HOBBS (J. Chem. Physics, 1939, **7**, 318—322).—The lattice energies of solid H_2 and D_2 are -180.4 and -280.6 g.-cal. per mol., respectively, in good agreement with recorded experimental vals. Mol. vols. also agree well with observed data and are 23·24 c.c. (H_2) and 19·78 c.c. (D_2). For HD the computed vals. are : lattice energy, -242.6 g.-cal. per mol. and mol. vol., 20·96 c.c.   W. R. A.

Molecular volume of water in complex compounds. P. G. SPACU (Bull. Acad. Sci. Roumaine, 1939, **21**, 35—37).—Determinations of the mol. vol. of cis-[Co en$_2$Cl$_2$]Cl, cis-[Co en$_2$Cl(H$_2$O)]Cl$_2$, and cis-[Co en$_2$(H$_2$O)$_2$]Cl$_3$ give vals. 14·18 and 14·20 for the mol. vols. of the first and second H_2O, respectively, calc. from vals. for Co, Cl, and en at 0° K. trans-[Co en$_2$Cl$_2$]Cl gives too low a val. The mol. vol. of the H_2O in the interior of the complexes is equal to that at 0° K.   L. J. J.

Dispersion of water for electromagnetic waves. L. L. ŠKOLIL (Physical Rev., 1939, [ii], **55**, 880—881; cf. Knerr, A., 1938, I, 12).—Using the method of standing waves inside a Cu pipe with a concentrically placed wire, n for H_2O was investigated for λλ 50—100 cm. A variation in n of $\sim$0·45±0·07% gives conclusive evidence of dispersion in this region. Data obtained are : for $\lambda = 52.84$ cm., $n = 8.799$, and for $\lambda = 105.68$ cm., $n = 8.839$ for H_2O of conductivity 0.3×10^7 e.s.u. at 25°. The probable error was <0·01% in measuring λ in air and <0·04% in measuring λ in H_2O.   N. M. B.

Double refraction of streaming molecular liquids. W. BUCHHEIM, H. A. STUART, and H. MENZ (Z. Physik, 1939, **112**, 407—419).—An apparatus is described for measuring double refraction in streaming liquids of low viscosity, where the rate of streaming can be controlled, or caused to pass the turbulence limit. The Maxwell const. is derived for a no. of org. liquids.   L. G. G.

Molecular and electronic effects of substituent on the optical activity of tartaric acid. Optical activity and chemical structure in tartaric acid. VIII. Y. TSUZUKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **35**, 466—480).—The optical rotation of cyclic derivatives of tartaric acid of the form

$$\underset{R''}{\overset{R'}{>}}C\underset{O\cdot CH\cdot CO_2R}{\overset{O\cdot CH\cdot CO_2R}{<}} \text{ and } \underset{R''''}{\overset{R'''}{>}}C\underset{O\cdot CH\cdot CO_2R}{\overset{O\cdot CH\cdot CO_2R}{<}} \text{ has}$$

been determined in the liquid state and in solution in cyclohexane (I), EtOH, and C_6H_6. The lævo-rotation of the compound is the smaller the larger are R' and R'', a fact which may be expected from the mol. theory of optical activity, and from the view that the O of OH contributes the positive partial rotation to tartaric acid. In derivatives of symmetrical ketones where R' = R'', the mol. rotation is always < that of the corresponding unsymmetrical isomeride. This may be due to an electronic effect. Where the cyclic compounds contain an aromatic nucleus the rotation is greatly affected by the position and chemical nature of the substituent in the nucleus. o- and m-Substitution effects are opposite, as are also the effects of NO$_2$ and OH. The effect of Cl is intermediate between those of OH and NO$_2$. These facts can be explained by an electronic drift together with an inductive effect. The effect of p-substitution is not influenced by the nature of the substituent. The effect of solvents on the optical activity of derivatives of tartaric acid is in the order C_6H_6 > EtOH > (I). This is partly due to the high n of C_6H_6. Dipole association between solute and solvent also enters.
                                          A. J. M.

Optical activity of the sugars. E. GORIN, W. KAUZMANN, and J. WALTER (J. Chem. Physics, 1939, **7**, 327—338).—The optical activities of some pentose sugars, calc. by using the one-electron theory (cf. A., 1939, I, 61), have signs identical with those observed, and are of equiv. magnitude. Superposition rules, which can be derived on the basis of the additivity of vicinal effects, are discussed, but certain requirements on the structure of the pyranose ring must be fulfilled.   W. R. A.

Influence of molecular interaction on the magnetic birefringence of polar liquids. A. PIEKARA (Compt. rend., 1939, **208**, 990—992).—The existence of intermol. coupling in $PhNO_2$ is discussed. Assumption of coupling of the second type (A., 1938, I, 178) gives a calc. val. of the mol. Cotton-Mouton const., C_m (cf. König, A., 1938, I, 177), which is in agreement with experiment.   A. J. E. W.

Magnetic rotatory power of heavy water. Dispersion and thermal variation. G. DUPOUY and C. FERT (Compt. rend., 1939, **208**, 1298—1300).—Relative vals. of the dispersion (which is independent of temp. between 0·7° and 94°) at 4358, 4910, 5461, 5780, and 5893 a. are recorded. Vals. of the Verdet const. Λ (1·478—1·445 × 10^{-2}) and the sp. const. [Λ] (1·337—1·351 × 10^{-2}) at 0·73—94° are given (λ 5461 a.); [Λ] approaches a limiting val. at $\sim$70°. The technique of the measurements is described.   A. J. E. W.

Circular magnetic dichroism of cobalt thiocyanates. J. VERHAEGHE and M. VAN EYCK (Compt. rend., 1939, **208**, 993—994).—Curves showing the variation with λ of the magnetic rotation (ω) and circular magnetic dichroism (φ) of an COMe$_2$ solution of Na$_2$Co(SCN)$_4$, in the neighbourhood of absorption bands (586 and 630 mμ.), are given. ω shows two superposed asymmetric anomalies with opposing max. The φ ellipticity is positive at $\sim$630 and negative at $\sim$586 mμ., in accord with Natanson's law.
                                          A. J. E. W.

Extended co-ordination theory [of valency]. I. Configuration of simple compounds of typical elements. R. TSUCHIDA (Bull. Chem. Soc. Japan, 1939, **14**, 101—106).—All chemical bonds may be interpreted in terms of co-ordinate covalency. If it is assumed that mols. and the ions of radicals are built up by the co-ordination of mols., ions, and electrons around central cations, the combining fields of which are given by sets of wave-functions, the configuration of simple and complex compounds could be calc. easily.   T. H. G.

Extended co-ordination theory of valency. II. Configuration of carbon compounds. R. Tsuchida (Rev. Phys. Chem. Japan, 1939, **13**, 31—41; cf. preceding abstract).—The author's method of formulation is applicable to C compounds and gives the observed configurations. F. J. G.

Space arrangements of atoms. I. Configuration of nitrogen in the 3-covalent state. B. K. Singh (Proc. Indian Acad. Sci., 1939, **9**, A, 323—327).—A detailed account of work already noted (cf. A., 1939, 1, 182). W. R. A.

Structure of boron hydrides. L. E. Agronomov (J. Gen. Chem. Russ., 1939, **9**, 73—82).—The various hydrides are represented as residual valency complexes of B^{III} hydrides (BH_3, B_2H_4, B_3H_5, B_4H_6, B_5H_7). The formation and reactions of the hydrides are considered from the viewpoint of the electronic theory. R. T.

Acids and bases. M. Usanovitsch (J. Gen. Chem. Russ., 1939, **9**, 182—192).—Theoretical. Acids and bases are defined as substances containing electropositive or -negative atoms or ionic groupings with unsatisfied co-ordination valencies. R. T.

Reciprocal influence of valency in the carbon atom. T. Förster (Z. physikal. Chem., 1939, **B**, **43**, 58—78).—Theoretical. The influence of neighbouring linkings of the C atom on one another is treated from the quantum-mechanical viewpoint. Ring-tension phenomena are discussed in the light of Baeyer's theory. W. R. A.

Electronic energy of the ground state of methane. M. M. Biedermann and S. R. de Groot (Physica, 1939, **6**, 421—424).—Theoretical. For the model $C^{++++} + 4H^-$, it is not sufficient to consider interaction only between pairs of ions. L. J. J.

Vibration–rotation energies in the tetrahedrally symmetric XY_4 type of molecule. W. H. Shaffer, H. H. Nielsen, and L. H. Thomas (Physical Rev., 1939, [ii], **55**, 878—879).—Mathematical. N. M. B.

Ionic character in diatomic molecules. F. T. Wall (J. Amer. Chem. Soc., 1939, **61**, 1051—1053).—Assuming the wave function of a mol. to be given by $\psi = \psi_c + a\psi_i$, where ψ_c and ψ_i are the covalent and ionic contributions, an expression for a^2 has been derived and vals. have been determined empirically for H halides and are correlated with the ionic charge and dipole moment vals. W. R. A.

Antisymmetrical molecular orbitals. II. Calculation of integrals. A. L. Sklar and R. H. Lyddane (J. Chem. Physics, 1939, **7**, 374—379; cf. A., 1938, I, 602). W. R. A.

Dissociation treatment of condensing systems. W. Band (J. Chem. Physics, 1939, **7**, 324—326).—Mathematical. W. R. A.

Rôle of affinity in statistical mechanics. T. de Donder (Wis- en natuurk. Tijds., 1936, **8**, 1—7; Chem. Zentr., 1936, ii, 1860).—A relationship between the chemical potentials of Gibbs and of the author, and an affinity equation, are derived and applied to a perfect gas. A. J. E. W.

Critical and co-operative phenomena. IV. Theory of disorder in solids and liquids and the process of melting. J. E. Lennard-Jones and A. F. Devonshire (Proc. Roy. Soc., 1939, **A**, **170**, 464—484).—A simplified presentation of the theory previously developed (cf. A., 1939, I, 248) is based on the idea of long-distance order. An expression for the melting temp. under zero pressure is obtained which gives vals. of the right order of magnitude for Ne, A, N_2, CO, CH_4, and H_2; the calc. val. for O_2 is too great. The sp. vols. of solid and liquid and the coeff. of expansion of the liquid are also calc. Lindemann's formula is deduced from the theory and the existence of a crit. temp. for melting is discussed. G. D. P.

Parachor and zero-point volume. W. Biltz and O. Hülsman (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., III, 1936, **1**, 147—156; Chem. Zentr., 1936, ii, 1864).—It is shown that for liquids with low v.p. $[P]/MV_0 = a$ const. $(k) = \sim 2\cdot 9$. This relation is in agreement with experimental data for mols. of all types, k having a mean val. of $2\cdot 97$. Hydrocarbons with uneven nos. of C atoms give lower k vals. than those with even nos., owing to vibration effects in the crystals. Vitreous substances give low vals. of k. The k val. is a criterion for distinguishing between true mol. compounds and salt-like substances. Vals. of k for CsI and LiF differ less for supercooled melts than for the crystals. The determination of d for a no. of liquid halides at low temp. is described. A. J. E. W.

Surface tension in different states of aggregation. G. Antonow (Ann. Physik, 1939, [v], **35**, 84—96).—Theoretical. The determination of the surface tension of solids is discussed. O. D. S.

Is it possible to derive a structure model of a crystal exclusively from the diffraction phenomena of X-rays? J. M. Bijvoet and C. H. MacGillavry (Chem. Weekblad, 1939, **36**, 330—331).—It is possible by making use of the fine structure of Kossel lines to determine structure exclusively from diffraction phenomena. S. C.

Applications of isomorphism. M. Delépine (Helv. Chim. Acta, 1939, **22**, 519—541).—A lecture. J. W. S.

Fourier lattice and thermal agitation. C. Mauguin and J. Laval (Compt. rend., 1939, **208**, 1446—1450).—The effect of thermal agitation waves on a crystal is to form additional virtual masses in the Fourier lattice in the neighbourhood of each node. The magnitude and co-ordinates of these masses in a cubic crystal are derived in terms of the parameters of a train of agitation waves. A. J. E. W.

Occurrence of true curved crystal faces in crystallisation from solutions. H. Spehl (Jahrb. Min. Beil.-Bd., 1936, **71**, 121—162; Chem. Zentr., 1936, ii, 1307).—The growth of K acetonedisulphonate crystals from aq. solutions has been studied. Becke's view that curved faces are due to deficient growth is confirmed, true or apparent curved faces being merely pseudo-faces. A. J. E. W.

Curie's law. Law of growth of crystals in presence of tenso-active substances. F. Barillet

and A. CHOISNARD (Bull. Soc. Franç. Min., 1938, **61**, 297—303).   L. S. T.

Lattice constants of the C-forms of the oxides of the rare-earth metals. H. BOMMER (Z. anorg. Chem., 1939, **241**, 273—280).—Vals. of a have been redetermined as follows: Nd_2O_3, 11·05 A.; Sm_2O_3, 10·89 A.; Eu_2O_3, 10·84 A.; Gd_2O_3, 10·80 A.; Tb_2O_3, 10·69 A.; Dy_2O_3, 10·63 A.; Er_2O_3, 10·50 A.; Tm_2O_3, 10·45 A.; Yb_2O_3, 10·41 A.; Lu_2O_3, 10·37 A. Most of these agree with older determinations, but differences are found with Sm_2O_3 and Tm_2O_3. When plotted against the at. no. they give two smooth curves, intersecting at Gd. This is in accordance with the views of Klemm (A., 1938, 1, 499), but the relationship has hitherto been obscured by the older, erroneous vals. for Sm_2O_3 and Tm_2O_3.   F. J. G.

Structures of complex fluorides. Potassium heptafluoniobate and heptafluotantalate. Configuration of the heptafluo-niobate and -tantalate ions. J. L. HOARD (J. Amer. Chem. Soc., 1939, **61**, 1252—1259).—From X-ray data the isomorphous crystals of K_2NbF_7 and K_2TaF_7 possess nearly identical monoclinic (pseudo-orthorhombic) units, a_0 5·85, b_0 12·67, c_0 8·50 A., β 90°, space-group, C_{2h}^5— $P2_1/c$, 4 mols. per unit cell. Parameters and at. separations are given.   W. R. A.

Crystal structure of glycine. G. ALBRECHT and R. B. COREY (J. Amer. Chem. Soc., 1939, **61**, 1087—1103).—X-Ray data for glycine indicate a simple monoclinic cell, a_0 5·10, b_0 11·96, c_0 5·45 A., β 111° 38′, containing 4 mols., space-group C_{2h}^5—$P2_1/n$. At. parameters have been derived from Patterson–Harker projections of photographic intensities. The structure consists of practically flat glycine mols. held together by H-bonds between adjacent C and N atoms to form continuous layers throughout the crystal. Interat. distances are (in A.): C—O 1·25 and 1·27, C—C 1·52, C—N 1·39; H-bond distances between N and O in the same layer are 2·76 and 2·88 and between neighbouring layers 2·93 and 3·05 A. The at. arrangement suggests a zwitterion structure for the glycine mol. in the crystal.   W. R. A.

Crystal structure of diphenylamine. I. J. DHAR (Indian J. Physics, 1939, **13**, 27—29).—Goniometric measurements on crystals of $NHPh_2$ indicate that they belong to the monoclinic holohedral class, $a : b : c = 1·01 : 1 : 2·78$, β 91° 30′. X-Ray measurements give a_0 14·0, b_0 13·9, c_0 39·5 A. (axial ratio 1·01 : 1 : 2·84), 32 mols. per unit cell.   W. R. A.

Changes in the X-ray pattern of the polyfructosan irisin on drying. J. R. KATZ and C. S. FULLER (Rec. trav. chim., 1939, **58**, 493—486; cf. A., 1931, 428).—The X-ray pattern of irisin shows definite intensity changes when the material is dried, which indicates that the absorption of H_2O is predominantly intermicellar.   D. F. R.

Fourier analysis of electron diffraction [intensities] for free molecules. M. ROUAULT (Compt. rend., 1939, **208**, 1290—1292).—The use of the charge-density function of Debye and Pirenne (A., 1939, I, 64) necessitates measurement of intensities over large diffraction angles. An analogous

potential function is derived which, applied to $SbCl_5$, requires intensity vals. for $\sin \frac{1}{2}\theta/\lambda = 0·05$—2·4.   A. J. E. W.

Electron diffraction rings produced by hydroxide contamination. L. H. GERMER (Z. Krist., 1938, **100**, 277—284; cf. Cairns, A., 1933, 352).—Spurious rings obtained in the transmission technique are shown, by comparison and structure analysis, to be due to hexagonal $Ni(OH)_2$ crystals (a 3·11 A.) oriented with the basal plane parallel to the supporting org. foil (Resoglaz, cellulose nitrate, etc.) but axially at random. The impurity, ~3 A. thick, is derived from aq. solution of a surface corrosion film on the " nickel-silver " slit alloy (I). Prepared $Ni(OH)_2$ films 50 A. thick show less perfect orientation and modified line intensity. Any traces of $Ni(OH)_2$ on polished blocks of Ni or (I) are masked, in the reflexion method, by Ni and Cu_2O patterns, respectively.   I. McA.

Electron diffraction investigation of phosphorus sulphoxide, $P_4O_6S_4$. A. J. STOSICK (J. Amer. Chem. Soc., 1939, **61**, 1130—1132).—The structure of $P_4O_6S_4$ has been determined by electron diffraction in the gas phase. The 4 P atoms are at (a, a, a), $(a, \bar{a}, \bar{a})$, $(\bar{a}, \bar{a}, a)$, and $(\bar{a}, a, \bar{a})$; 6 O at $(\pm b, 0, 0)$, $(0, \pm b, 0)$, and $(0, 0, \pm b)$; 4 S at (c, c, c), $(c, \bar{c}, \bar{c})$, $(\bar{c}, \bar{c}, c)$, and $(\bar{c}, c, \bar{c})$. Interat. distances are P—O, 1·61±0·02; P—S, 1·85±0·02; P—P, 2·85± 0·03 A. Valency angles are O—P—O, 101·5±1°; P—O—P, 123·5±1°; O—P—S, 116·5±1°. The shortening of the P—O and P—S bond distances below the single and double bond vals. is attributed to single-double bond and double–triple bond resonance respectively.   W. R. A.

Determination of the molecular structure of tetranitromethane by the electron diffraction method. A. J. STOSICK (J. Amer. Chem. Soc., 1939, **61**, 1127—1130).—From electron diffraction data the following structure is proposed for $C(NO_2)_4$: 4 NO_2 groups attached tetrahedrally to the C; C—N distance 1·47±0·02 A.; N—O distance 1·22± 0·02 A.; O—N—O angle in the NO_2 127°. Satisfactory intensity agreement is obtained by assuming that the NO_2 are undergoing rotatory oscillation about the C·N linkings so as to minimise the repulsions between the O atoms, and by including the temp. factor in the intensity formula.   W. R. A.

Determination of the thinnest layer of electrolytically-deposited iron at which magnetic discontinuities disappear. S. PROCOPIU (Compt. rend., 1939, **208**, 1212—1214).—The circular Barkhausen effect in a Cu wire coated electrolytically with Fe, under torsion (cf. A., 1937, I, 290), is not observed if the Fe layer is <1·75 μ. thick; above this limit the magnetic induction in the coaxial coil shows a linear variation with the thickness of the layer. It is concluded that 1·75 μ. is the min. size of a Weiss elementary region.   A. J. E. W.

Magnetic properties of bismuth. III. Further measurements on the de Haas–van Alphen effect. D. SHOENBERG (Proc. Roy. Soc., 1939, **A, 170**, 341—364; cf. A., 1937, I, 18).—The periodic variation of the susceptibility of single crystals of Bi

has been measured at fields down to 1500 gauss in the temp. range 2—20° K. The results are in qual. agreement with theory; numerical vals. for the "effective" electronic masses and the degeneracy temp. are given, from which it is deduced that the no. of electrons responsible for the effect is 1.7×10^{-6} per atom. G. D. P.

Inner, initial, magnetic permeability of iron and nickel at ultra-high radio-frequencies. J. L. GLATHART (Physical Rev., 1939, [ii], **55**, 833—838).—A new and more accurate and rapid method of measurement for ferromagnetic materials is described. The magnetic permeability of high-purity commercial Fe wire was 53.8 ± 0.3 at 1.97×10^8 cycles per sec., and 25°, and was const. for all tensions up to the breaking point of the wire at 980 g. and for superimposed longitudinal magnetic fields up to 100 oersteds. The val. for commercially pure Ni was 3.61 ± 0.08 at the same frequency and temp.; with rise of temp. it increased to 12.22 at 320°, beyond which it dropped rapidly to 1 at 370°. N. M. B.

Relation between the Curie points of the metals of the ytterbium earth group. L. NÉEL (Z. Elektrochem., 1939, **45**, 378—379; cf. A., 1938, I, 127).—An equation relating the Curie temp. of the elements Gd to Tm with their quantum nos. is derived. J. W. S.

Phase increment of 2π in reflexion from metals. P. ROUARD (Compt. rend., 1939, **208**, 1294—1296).—Under certain conditions (which are discussed) a phase lag due to reflexion of light at a thin metallic film may change abruptly to a phase lead, owing to a phase increment of 2π. A. J. E. W.

Supposed high-temperature polymorphism of tin. C. W. MASON and G. E. PELLISSIER (Amer. Inst. Min. Met. Eng., Tech. Publ. 1043, 1939, 13 pp.; Met. Tech., 1939, **6**, No. 3).—Back-reflexion powder X-ray photographs of pure Sn at various temp. between 25° and 200° and at atm. pressure showed no indication of any structure but that of tetragonal β-Sn. Microscopical observations at temp. up to the m.p. of Sn revealed no structural change except grain growth. Grain growth occurred at temp. <100° in cast Sn protected from external deformation. It is concluded that no evidence exists for γ-Sn. R. B. C.

Supersonic dispersion and infra-red radiation. E. G. RICHARDSON (Nature, 1939, **143**, 638—639).—Supersonic absorption by CO_2 is apparently increased by subjecting the gas to infra-red radiation corresponding with its own natural vibration frequencies. L. S. T.

Measurement of certain adiabatic elastic constants of crystals by means of ultrasonic waves. E. BAUMGARDT (Compt. rend., 1939, **208**, 1280—1282). —A method of determining the elastic moduli c_{11} and $c_{12} + 2c_{44}$ for a cubic crystal by measuring the velocity of sound (v) in the crystal is developed. v is determined by the ν at which a plate of known thickness becomes transparent to ultrasonic waves, transparency being detected by a diffraction method. Data for natural and artificial NaCl crystals are in agreement with those of Rose (A., 1936, 276). A. J. E. W.

Ultrasonic velocity and the adiabatic compressibility of some liquids. S. BHAGAVANTAM and C. V. J. RAO (Proc. Indian Acad. Sci., 1939, **9**, A, 312—315).—The adiabatic compressibilities of C_6H_6, CCl_4, CS_2, cyclohexanol (I), Ac_2O, and glycerol (II), calc. from measurements of the ultrasonic velocity v in these liquids, agree with the vals. obtained directly with a piezometer. For CCl_4 v at 27.5° is const. at 932 m. per sec. in the frequency range 1.5—13.08 megacycles. Measurements on (I) (30—80°) and (II) (28.5—70°) indicate that viscous liquids do not exhibit an abnormal temp. coeff. of v at moderate temp. The gradient is ~3.0 m. per sec. per degree, which $\simeq$ that of less viscous liquids (PhMe, CCl_4). W. R. A.

Thermal and electrical resistance of bismuth single crystals. Effects of temperature and magnetic fields. G. W. C. KAYE (Proc. Roy. Soc., 1939, **A**, **170**, 561—583).—The thermal and electrical resistivities were measured in the range 25—160°. The vals. in the direction parallel to the trigonal axis are > those in directions at right angles. The temp. coeff. of electrical resistivity is approx. twice that of thermal resistivity. The effects of magnetic fields up to 20,000 gauss were investigated in different crystal orientations. The magnetic field increases the resistivities, the effect being greatest when the flow of heat or electricity is parallel to the trigonal axis and the field is at right angles to one of the digonal axes. The observations support the view that there are two conducting mechanisms through the medium of which the magnetic field affects the conductivity. G. D. P.

Transitions of ferrous sulphide. H. HARALDSEN (Z. Elektrochem., 1939, **45**, 370—372).—X-Ray measurements indicate that the transition of FeS at ~135°, characterised by an abrupt change in χ (A., 1937, I, 242), is a phase change of the first kind, accompanied by an abrupt change in the dimensions of the c axis. The other transition, at ~325°, is a lattice change of the second kind, and is accompanied only by a change in the temp. coeff. of the lattice const. The interpretation of the transitions is discussed. J. W. S.

Magnetochemical studies. XXXII. Magnetic measurements on alkali metal amalgams. W. KLEMM and B. HAUSCHULZ. **XXXIII. Magnetic behaviour of some elements.** L. KLEMM. **XXXIV. Magnetic behaviour of scandium, yttrium, and lanthanum.** H. BOMMER (Z. Elektrochem, 1939, **45**, 346—353, 354—357, 357—362; cf. A., 1939, I, 247).—XXXII. The following vals. for $\chi \times 10^{-6}$, independent of temp., are recorded : Na 0.664 ± 0.002, K 0.532 ± 0.002, Rb 0.228 ± 0.002, Cs 0.226 ± 0.001. The vals. of χ for various Na, K, Rb, and Cs amalgams have been determined at 20° and at —183°. The max., min., and inflexions in the χ-composition curves can in most cases be correlated with thermo-analytical measurements, but the compounds Na_3Hg, $RbHg_9$, Rb_2Hg_7, and $CsHg_{10}$ cannot be observed magnetically. Evidence is obtained for the existence of compounds $NaHg_3$, $RbHg_{10}$, RbHg, and Cs_3Hg_4, the possible existence of KHg_{13}, KHg_8, and K_4Hg_3, and of compounds of the approx.

composition $CsHg_{20}$, and $CsHg$, none of which is detectable by thermal analysis.

XXXIII. The following vals. of $\chi \times 10^{-6}$, for 20° and —183°, respectively, are recorded : B —0·62 and —0·63, Ti 3·19 and 3·02, Zr 1·34 and 1·30, Th 0·75 and 0·66, V 4·5 and 4·5.

XXXIV. The following vals. for $\chi \times 10^{-6}$, for 292°, 195°, and 90° K., respectively, are recorded : Sc 7·0, 7·5, and 8·2, Y 2·15, 2·23, and 2·43; La 0·81, 0·83, and 0·99. The high val. of χ for Sc and its large temp. coeff. resembles the behaviour of Pt and Pd. The variation of at. susceptibility in the various groups of the periodic system is discussed.

J. W. S.

Magneto-chemical investigations at the chemical laboratories of the University of Lahore. S. S. BHATNAGAR and P. L. KAPUR (Z. Elektrochem., 1939, 45, 373—378).—A review of recent magneto-chemical investigations of the structure of Cr and Mn compounds, metals and amalgams, photochemical problems, and the polymerisation of unsaturated hydrocarbons.

J. W. S.

Magnetochemical investigation of organic compounds. XVI. Constitution and magnetic behaviour of metallic ketyls. E. MÜLLER and W. JANKE (Z. Elektrochem., 1939, 45, 380—395; cf. A., 1939, II, 83).—The influence of inductive (A) and electromeric (E) effects of substituent groups in modifying the concn. (c) of free radical present in the K compound of $COPh_2$ has been investigated. Owing to its strong positive E-effect p-NMe_2 groups change c from 77% for the K compound of $COPh_2$ to 30% for p-$COPh \cdot C_6H_4 \cdot NMe_2$ and 96% for $CO(C_6H_4 \cdot NMe_2)_2$. OMe, with relatively small E-effect but large A-effect, reduces the val. of c. These results are compared with those for analogous substitution products of C_2Ph_6. The linkage between the rings in fluorenone results in reduction of c to 25%. In xanthone and 2 : 3-benzoxanthone c is reduced to 32% and 9%, respectively, and it disappears completely for 2 : 3 : 6 : 7-dibenzoxanthone, which is diamagnetic. On the other hand for tetraphenyl*cyclo*pentadienone $c = 83\%$. The electron configurations producing this effect are discussed. Similar behaviour is found with the K_1 compounds of diketones, c for the K derivatives of benzil and pp'-diphenylbenzil being 71% and 75%, respectively, whilst for phenanthraquinone $c = 37\%$. The free radical content increases with the at. wt. of the alkali metal with which the ketone is combined, this being in accord with the view that the linking between the metal and the org. grouping will assume a more ionic nature the higher is the at. wt. of the metal. Measurement of the variation of magnetic susceptibility with temp. for the K derivatives of various ketones suggests that in each case there is an equilibrium between the low-temp. diamagnetic and the high-temp. paramagnetic states, the natures of which are discussed.

J. W. S.

Diamagnetism of the rare gases of the air, argon, krypton, and xenon. L. ABONNENC (Compt. rend., 1939, 208, 986—988; cf. A., 1936, 416).—A method of measuring $\varkappa$ for gases is

described, in which the concn. (c) of a paramagnetic solution ($CuSO_4$) is adjusted until the wt. of drops formed in the gas is unaltered by application of a magnetic field; $\varkappa$ is calc. from the c vals. for the unknown gas and a standard (H_2). The following vals. of χ_a are obtained : A, —19·2±0·25; Kr, —29·2±0·2; Xe, —44·1±0·2, all $\times 10^{-6}$.

A. J. E. W.

Magnetism and magnetic substances. F. LORI (Scientia, 1936, 59, 305—315; Chem. Zentr., 1936, ii, 1311—1312).—A discussion, particularly of the relations between magnetic phenomena and the fine structure of matter.

A. J. E. W.

Visible demonstration of ferromagnetic mosaic structure. A. PERRIER (Helv. Phys. Acta, 1936, 9, 330—332; Chem. Zentr., 1936, ii, 1312).—The mosaic structure of Weiss elementary magnets is rendered visible by polarised light, owing to the occurrence of a Kerr effect.

A. J. E. W.

Metals of the rare earths. W. KLEMM and H. BOMMER (Z. anorg. Chem., 1939, 241, 264—267).—The Pr and Nd preps. used in previous work (A., 1937, 257) were not sufficiently pure; the work has been repeated using purer materials. χ for Pr fulfils the Curie law and gives an effective moment of 3·49 Bohr magnetons. This is $\ll$ the val. for the Pr‴ ion (3·61) and suggests the presence of 14% of Pr^{IV} in the metal. The effective moment of Nd is 3·65, in agreement with the val. for the Nd‴ ion (3·68). α-Pr has a 3·662, c 5·908 A., c/a 1·613, and Nd has a 3·650, c 5·890 A., c/a 1·613.

F. J. G.

Magne–crystallic action. VI. Paramagnetic crystals. K. S. KRISHNAN, A. MOOKHERJI, and A. BOSE (Phil. Trans., 1939, A, 238, 125—148).—The magnetic anisotropies of some typical salts of the Fe and rare-earth groups have been determined down to ~90° K. A cryostat, with automatic temp. control, used in the investigation is described. For $Gd_2(SO_4)_3,8H_2O$ and $Mn(NH_4)_2(SO_4)_2,6H_2O$, which have paramagnetic ions in the S-state, the anisotropy, $\Delta\chi$, $\propto 1/T^2$. The magnetic anisotropy of $Gd_2(SO_4)_3,8H_2O$ was particularly studied. The max. $\Delta\chi$ is $\gg$ would be expected from the Stark separation of the S-levels of Gd‴ under the influence of electric fields in the crystal, and appears to be due to magnetic interaction of Gd‴. The effect of the orbital angular momenta of paramagnetic ions on their magnetic behaviour in crystals is discussed. The coupling (λ) between the orbital and spin angular momenta in Ni‥ is obtained from determinations of $\Delta\chi$ at 21° and —183° for $NiSeO_4,6H_2O$ and $NiSO_4,6H_2O$. The val. is —330 cm.$^{-1}$, agreeing satisfactorily with spectroscopic determinations (—335 cm.$^{-1}$). The variation of χ with temp. for the above Ni salts has also been determined and is expressed by an empirical equation. The anisotropy of $(NH_4)_3Cr(C_2O_4)_3,3H_2O$ has been determined. Cr‴ has very small $\Delta\chi$, almost as small as if the ion was in the S-state instead of ^4F. This explains the suitability of Cr‴ salts as materials for the production of low temp. by adiabatic demagnetisation. $\chi_{\parallel} - \chi_{\perp}$ for $Pr_2(EtSO_4)_6,18H_2O$ and $Sm_2(EtSO_4)_6,18H_2O$ at first increases as temp. decreases, reaches a max., and then falls rapidly. The anisotropy of rare-earth

chlorides and sulphates at room temp. has also been investigated. The magnetic data show that salts of the type $R_2CuCl_4,2H_2O$ (R = NH_4, K, Rb) are double salts rather than complexes. A. J. M.

Variations in the specific coefficient of magnetisation of oxyhæmoglobin in presence of sodium hydroxide and hydrochloric acid. (MLLE.) P. BERTHIER (Compt. rend., 1939, **208**, 1435—1437).—The sp. coeff. of magnetisation (k) of oxyhæmoglobin (I) in aq. 2·5% KCl containing different concns. of NaOH or HCl is measured as described previously (cf. A., 1939, III, 622). NaOH makes solutions of (I) diamagnetic; the greater is the concn. of NaOH the greater is the change in k when the solution is kept at 7°. HCl causes the solution to become paramagnetic; k is considerably increased and passes through a max. val. when the solutions are kept. k decreases as the p_H increases.
J. L. D.

Atomic heat of potassium. L. G. CARPENTER and C. J. STEWARD (Phil. Mag., 1939, [vii], **27**, 551—564).—Using an apparatus (described), which includes an all-Ni calorimeter, the at. heat of K has been determined from —70° to 336°, thus covering both the solid (m.p. 63·41°) and the liquid phases. The latent heat of fusion is 0·568 kg.-cal. per g.-atom. Vals. of C_p and C_v are given and discussed. The val. 7·26 g.-cal. per g.-atom obtained is definitely > $3R$. W. R. A.

Specific heat of iron from 1·5° to 20° K. G. DUYCKAERTS (Physica, 1939, **6**, 401—408, and Compt. rend., 1939, **208**, 979).—From 1·5° to 9° K., with 99·8% Fe, $C = 464·5(T/\theta)^3 + 1·20 \times 10^{-3}T$ g.-cal. per g.-atom per degree; the linear term, representing the electronic sp. heat, is > that calc. from Sommerfeld's theory. Between 9° and 50° K., θ increases, and then decreases to a const. val. 430. L. J. J.

Specific heats at low temperatures of beryllium oxide and beryllium orthosilicate (phenacite). K. K. KELLEY (J. Amer. Chem. Soc., 1939, **61**, 1217—1218).—Sp. heats of BeO and Be_2SiO_4 from 52·5° to 298·1° K. have been measured. For BeO and Be_2SiO_4 $S_{298·1}$ is 3·37±0·05 and 15·4±0·1 respectively. $\Delta G^\circ_{298·1}$ for BeO is —140,320. W. R. A.

Gaseous heat capacities. I. Method and heat capacities of ethane and hexadeuteroethane. G. B. KISTIAKOWSKY and W. W. RICE (J. Chem. Physics, 1939, **7**, 281—288).—An abs. method for determining heat capacities ($C_p^\bullet$) of gases, which does not involve comparison with other gases of known $C_p^\bullet$, is described and data for air and CO are compared with theoretical vals. The $C_p^\bullet$ of C_2H_6 and C_2D_6 have been determined from 0° to 90°. C_2D_6 has the higher $C_p^\bullet$. W. R. A.

Low-temperature gaseous heat capacities of ethane and hexadeuteroethane. G. B. KISTIAKOWSKY, J. R. LACHER, and F. STITT (J. Chem. Physics, 1939, **7**, 289—296).—The heat capacities of C_2H_6 and C_2D_6 have been determined from 94° to 335° K. by the low-pressure thermal conductivity method previously described (A., 1938, I, 184) but with certain modifications. A new method of calculating heat capacities from thermal conductivity data has been

employed. The heat capacity data are consistent with previous assumptions (ibid., 438) regarding the height and shape of the potential barrier restricting internal rotation. It is a cosine-shape barrier of 2750 g.-cal. per mol. Using this barrier and the spectroscopic data of Stitt (A., 1939, I, 354) the entropy of C_2H_6 at 298° K. is 54·95 g.-cal. per degree per mol., in good agreement with the third-law entropy of 54·85 (A., 1937, I, 175). W. R. A.

Behaviour of the reflecting power of iron for visible light near the Curie point and the α–γ transition point. J. H. VAN DER VEEN and L. S. ORNSTEIN (Physica, 1939, **6**, 439—452).—With electrolytic Fe heat-treated with H_2 and vac. the reflecting power shows a discontinuous increase at the α–γ transition point (~1200° K.), independent of λ for 4500—8500 A. The Curie point is associated with a continuous increase, which has a max. val. at λ 6500 A. and is inappreciable at λ 4500 A. Polarisation measurements showed that from 300° to 1200° K. the extinction coeff. increases, while the refractive index does not change appreciably. L. J. J.

Chemical constants of atoms and molecules. A. MAILLARD (Ann. Off. nat. Comb. liq., 1936, **10**, 247—264; Chem. Zentr., 1936, ii, 2867).—Formulæ for the consts. i_p and i_k (cf. A., 1930, 145) are given. Vals. of these consts. are tabulated, and their use in homogeneous and heterogeneous equilibrium calculations is described. A. J. E. W.

Transfer effect in liquid He II. I. The transfer phenomena. II. Properties of the transfer film. J. G. DAUNT and K. MENDELSSOHN (Proc. Roy. Soc., 1939, **A**, **170**, 423—439, 439—450; cf. A., 1938, I, 397, 566).—I. The experimental arrangements used to investigate the transfer of liquid He II are described. It is found that the liquid rises as a thin film on the surface of the containing vessel, passes over the edge, and collects at the lowest available level. The rate of transfer is ∝ the width of the connecting surface.
II. The heat-conductivity of the film is small; its thickness is about $3·5 \times 10^{-6}$ cm. The rate of transfer is const. from 1° to 1·5° K. and then falls to zero at 2·2° K. G. D. P.

Atomic number and some physical properties of elements. L. ROUGEOT (Bull. Soc. chim., 1939, [v], **6**, 794—804; cf. A., 1938, 392).—Relationships are derived expressing the ρ, at. vols., and coeff. of expansion of alkali metals in terms of their at. no. (Z). ρ and at. vol. relations are also derived for the alkaline-earth metals. The at. parachors and entropies of the inert gases and of halogens can also be expressed by $x = a + b \log z$, where a and b are consts. for each series. Linear relationships are also derived for the effective radii of normal atoms. J. W. S.

Density measurements on earth metals. H. BOMMER and E. HOHMANN (Z. anorg. Chem., 1939, **241**, 268—272).—Vals. for ρ have been determined as follows: Dy, 8·44; Eu, 5·30; Yb, 7·03; Sm, 6·93. The corresponding vals. of the at. vol. agree with the view (A., 1937, I, 257) that Dy contains tervalent ions, Eu and Yb bivalent ions, and Sm chiefly tervalent with some bivalent ions. F. J. G.

Temperature of maximum density of D_2O and of its mixtures with H_2O. E. SWIFT, jun. (J. Amer. Chem. Soc., 1939, **61**, 1293—1294).—Using a pyknometric method, which is described, the temp. of max. ρ of D_2O is $11.1\pm0.1°$ for two samples of different origin. Data for five D_2O–H_2O mixtures are given. W. R. A.

Density of single crystals of cupric acetate monohydrate. S. S. SIDHU and J. A. BERGER (J. Chem. Physics, 1939, **7**, 322—323).—Vals. for ρ of $Cu(OAc)_2,H_2O$ have been determined at $21°$, $23.5°$, and $25°$ by a pyknometer method and are $>$ recorded vals. The new val. at $21°$ in conjunction with X-ray data on the vol. of the elementary cell indicates that there are 8 mols. per unit cell. W. R. A.

Density and transition points of dotriacontane (dicetyl). W. F. SEYER and W. MORRIS (J. Amer. Chem. Soc., 1939, **61**, 1114—1117).—Pure dicetyl can be prepared from cetyl alcohol provided sufficient recrystallisations are made. Vals. of ρ from $20°$ to $85°$ have been determined by a dilatometric method and indicate the existence of two transition points in agreement with those of Piper et al. (A., 1932, 250). The reported transition point at 65.2—$65.4°$ (loc. cit.) was not confirmed. W. R. A.

Vapour pressure of xenon, the Lennard-Jones relation, and the constancy of T_e/T_k for the rare gases. K. CLUSIUS and K. WEIGAND (Z. physikal. Chem., 1939, **B, 43**, 78).—Addendum (cf. A., 1939, I, 190). W. R. A.

Quasi-statistical and non–statistical changes of state. T. EHRENFEST-AFANASSJEWA (Wis- en natuurk. Tijds., 1936, **8**, 29—34; Chem. Zentr., 1936, ii, 1861).—The use and thermodynamical significance of the terms " quasi- " and " non-statistical," which are preferred for " reversible " and " non-reversible " changes of state, are discussed. A. J. E. W.

Reversible and non-reversible processes. (A) J. E. VERSCHAFFELT. (B) T. EHRENFEST-AFANASS-JEWA (Wis- en natuurk. Tijds., 1936, **8**, 35—38, 38—40; Chem. Zentr., 1936, ii, 1861; cf. preceding abstract). A. J. E. W.

Quantum-mechanical calculation of the second virial coefficient of helium at low temperatures. J. DE BOER and A. MICHELS (Physica, 1939, **6**, 409—420; cf. A., 1939, I, 68).—The interaction energy between two He atoms already obtained is used in calculating an expression for B, giving at $2.58°$, $3.10°$, $4.22°$ K. vals. -123, -99.6, -69.4 cm.^{3}, as compared with the experimental vals. -117, -96.7, -74.7 cm.^{3} of Keesom and Kraak (A., 1935, 157). The cross-section for scattering of He on He is calc. L. J. J.

Coefficient of thermal conductivity of liquids and its variation with temperature. P. GUARESCHI (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 54—60; cf. A., 1938, I, 445).—An expression similar to that previously derived for the thermal conductivity coeff. of gases is found to hold for liquids. O. J. W.

Compressibility coefficient of liquids. P. GUARESCHI (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 61—69; cf. A., 1937, I, 70).—The previously derived expression for the compressibility coeff. of solids can

be extended to liquids, and applied to calculate the collision frequency of mols. in liquids. O. J. W.

Internal pressure in a liquid. M. F. SOONAWALA (Indian J. Physics, 1939, **13**, 31—41).—Mathematical. The internal pressure in H_2O is deduced from the equation of state derived from thermodynamical considerations under certain limiting conditions. Calc. vals. of the compressibility do not agree with observed vals. W. R. A.

Relationship between the viscosity of a liquid and the vapour concentration. G. W. MARKS (J. Physical Chem., 1939, **43**, 549—559).—Based on the observed linear relation between the log of the fluidity (ϕ) in rhes and the log of the corresponding vapour concn. (C) in mols. per l., a no. of empirical expressions connecting η or ϕ with v.p. or C have been derived. Vals. for the characteristic consts. ϕ_0 and m in the expression $\phi = \phi_0 C^m$ have been calc. for 52 liquids. Equations expressing the variations of ϕ or ρ with temp. have also been derived. C. R. H.

Molecular interaction in monolayers. Viscosity of two-dimensional liquids and plastic solids. V. Long-chain fatty acids. E. BOYD and W. D. HARKINS (J. Amer. Chem. Soc., 1939, **61**, 1188—1195).—A detailed account of work already noted (cf. A., 1939, I, 255). W. R. A.

Optical determination of coefficient of diffusion in a mixture of mercury vapour and hydrogen. J. L. SPIER (Physica, 1939, **6**, 453—457).—The val. 0.53 sq. cm. per sec. for Hg in H_2 at $0°$ and 760 mm. is found from photographic measurements in a discharge tube containing H_2 at $50°$ and 3 mm. L. J. J.

Thermodynamics of gas mixtures. E. JUSTI and M. KOHLER (Feuerungstech., 1939, **27**, 5—9).—The vol. of gas mixtures can be correctly calc. within the range of moderately high pressures for which the virial equation $pV = RT + Bp$ is valid. In general the vol. of a gas mixture is not a linear but a quadratic function of the mixing ratio. Figures are given for binary mixtures. The calculation of the vol. of mixtures of $>$ two components can be reduced to that for binary mixtures. Similar formulæ are developed for the pressure of actual gas mixtures; the total pressure may be $>$ or $<$ the sum of the partial pressures. The additivity of the coeff. of elasticity and of thermal expansion, and the liberation of heat of mixing, are discussed. R. B. C.

Maximum density and compressibility of salt solutions. J. H. C. MERCKEL (Rec. trav. chim., 1939, **58**, 465—470; cf. A., 1935, 1318).—The effect of alkali salts on the compressibility, K, and on the temp. of max. density, $\theta_{max.}$, of H_2O has been measured. Both $\Delta\theta_{max.}$ and K vary linearly with the lyotropic no. of the anion and quadratically with that of the cation. D. F. R.

Density of aqueous solutions of sodium hydroxide. G. ÅKERLÖF and G. KEGELES (J. Amer. Chem. Soc., 1939, **61**, 1027—1032).—The d of aq. NaOH (1—26M.) has been determined from $0°$ to $70°$. When vals. of apparent mol. vol. (ϕ) are calc. and plotted against $\sqrt{M}$., each isothermal curve

shows a break. The break moves to higher concn. with increasing temp. Equations for the curves on either side of the break have been derived. The partial mol. vol. of solvent and solute have been computed. Tentative explanations of the breaks are advanced.   W. R. A.

Apparent molar ionic volumes in aqueous solutions of strong electrolytes. G. W. STEWART (J. Chem. Physics, 1939, **7**, 381).—The variation of the apparent mol. ionic vol. ϕ of 197 strong electrolytes with concn. (*c*) has been studied. The Debye–Hückel linear equation $\phi = \phi_0 + kc^{0.5}$ (*k* dependent on at. no. and valency of the ions) is not satisfied by most of these electrolytes. Of these, 6 show anomalous variations with max. or min., 4 have a linear relation but *k* is negative, and the others follow the law approx. The simple electrostatic theory has therefore omitted important factors, of which one appears to be the variation of *d* due to alteration of the structure of the H_2O with concn.   W. R. A.

Jahn–Teller theorem and the arrangement of water molecules around paramagnetic ions in aqueous solutions. K. S. KRISHNAN (Nature, 1939, **143**, 600—601; A., 1937, I, 552).—The octahedra of H_2O mols. surrounding the cation in many of the salts of the Fe and rare-earth groups are inferred to be asymmetric, the degree of asymmetry being determined by the electronic state of the cation in the centre. This arrangement appears to exist even in aq. solutions of these salts.   L. S. T.

Viscosity of aqueous solutions of strong electrolytes of high ionic valency. E. ASMUS (Ann. Physik, 1938, [v], **35**, 1—22; cf. A., 1938, I, 309).—The variation with concn. of the viscosity of solutions of $CuSO_4$, $ZnSO_4$, $MgSO_4$, $CdSO_4$, $MnSO_4$, $Cr_2(SO_4)_3$, $Ca_2Fe(CN)_6$, and $Ca_3[Fe(CN)_6]_2$ has been investigated. Results agree with Falkenhagen's theory. The discrepancy for $MgSO_4$ (*ibid.*) disappears when measurements are continued to sufficiently low concns. The regulation of the period of temp. fluctuations in thermostats is discussed.   O. D. S.

Volatility of salts with steam. I. I. ISKOLDSKI (J. Appl. Chem. Russ., 1939, **12**, 17—25).—The gaseous phase over aq. solutions is H_2O vapour and air containing droplets of solution; the droplets have a negative or positive charge, according to the nature of the dissolved salt. The significance of this finding is discussed, with respect to analytical procedures involving evaporation of solutions. Electrofiltration of steam supplied to turbines is recommended, with a view of preventing corrosion of the blades.   R. T.

Physico-chemical analysis of non-aqueous solutions. III. M. A. KLOTSCHKO and O. P. TSCHANUKVADZE. IV. M. A. KLOTSCHKO (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 987—1002, 1003—1013; cf. A., 1937, I, 607).—III. The compound $NH_2Ph,2AcOH$ is suggested by max. or min. on the conductivity–, η–, and *d*–composition curves at low temp. It decomposes with rise of temp. forming non-conducting substances.

IV. Measurements of conductivity, η, and *d* of the system KBr–$AlBr_3$–$PhNO_2$ from 25° to 90° indicate that K is present in a complex cation, since the con-ductivity of the electrolyte, $KBr,AlBr_3$, is similar in the presence or absence of org. solvents when correction is made for influence of η, and diminishes with increasing concn. of $AlBr_3,PhNO_2$.   F. H.

Physico-chemical analysis diagrams of binary liquid systems. II. M. USSANOVITSCH (Bull. Acad. Sci. U.R.S.S. 1938, Sér. Chim., 961—970).—Polemical against Klotschko (A., 1937, I, 356).
          F. H.

Electroconductivity and viscosity diagrams and temperature coefficient curves of these properties for binary systems of components forming chemical compounds. M. A. KLOTSCHKO (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 971—986).—In binary systems forming stable chemical compounds, the min. on conductivity isotherms is related to the max. on the η isotherms, the composition of the compound corresponding with the max. on the conductivity– and the η–temp. coeff. curves. When less stable compounds are formed, the less is the dissociation of the compound, the closer is the agreement in the composition of the compound indicated by the range of max. of conductivity–temp. coeff. and of η–temp. coeff. curves. Criticism by Ussanovitsch (cf. preceding abstract) is replied to.   F. H.

System nickel–zinc. W. HEIKE, J. SCHRAMM, and O. VAUPEL (Metallwirts., 1936, **15**, 655—662; Chem. Zentr., 1936, ii, 1606—1607).—Saturation of the α mixed crystals is reached with 28—43% of Zn (room temp.—1040°). The peritectic reaction α + melt yields β' mixed crystals (body-centred cubic); NiZn is not produced by an α + β' reaction. The β'–(α + β') and β₁–(α + β₁) phase boundary lies at 50% Zn (room temp.—975°), and the γ–(β' + γ) boundary at 77% Zn (room temp.—675°). The hexagonal δ-phase has a narrow mixed crystal region.   A. J. E. W.

Equilibrium diagram of iron–nickel alloys. E. A. OWEN and A. H. SULLY (Phil. Mag., 1939, [vii], **27**, 614—636).—The positions of the α and β boundaries in the equilibrium diagram of the Fe–Ni system of alloys have been determined by *X*-ray methods. The effect of heat-treatment (up to 800°) on the alloys has been studied; spectra at high temp. were obtained, using a new fibre camera. With the aid of the new equilibrium diagram a tentative explanation of certain experimental data is given.
          W. R. A.

***X*-Ray study of iron–palladium and nickel-palladium systems.** R. HULTGREN and C. A. ZAPFFE (Amer. Inst. Min. Met. Eng., Tech. Publ. 1047, 1939, 11 pp.; Met. Tech., 1939, **6**, No. 3).—Ni and Pd form a complete series of solid solutions in which no compounds, superlattices, or miscibility gaps can be detected. There is a positive deviation from Vegard's law. Pd is only slightly sol. in α-Fe but forms a complete series of solid solutions with γ-Fe with a large positive deviation from Vegard's law. An intermediate stage in the decomp. of γ-Fe containing dissolved Pd was found and compared with the martensite transformation (cf. A., 1938, I, 613).   R. B. C.

Structure growth in iron–nickel–cobalt alloys and the perminvar problem. S. KAYA and M. NAKAYAMA (Z. Physik, 1939, **112**, 420—429).—Sp. heat–temp. curves have been determined for a no. of Ni–Fe and Ni–Fe–Co alloys over the range 100—700°. Variations in these curves and in the magnetic properties of the alloys with ageing and after various heat-treatments are considered in relation to changes in the macro-cryst. structure of the metals.

H. C. G.

Solubility and heat of dissolution of ozone in carbon tetrachloride. E. BRINER and E. PERROTTET (Helv. Chim. Acta, 1939, **22**, 585—587).—The absorption coeffs. of O_3 in CCl_4 at 0° and −12° are 2·8 and 4·6, respectively. From these vals. it is deduced that the heat of dissolution of O_3 in CCl_4 is 5900 g.-cal. per g.-mol.

J. W. S.

Solubility of hydrogen in aluminium and magnesium. P. RÖNTGEN and H. WINTERHAGER (Aluminium, 1939, **21**, 210—213).—Only a small portion of the H_2 absorbed by Al is evolved during heating, but successive deformations cause the liberation of increased amounts of gas. The H_2 evolution from Al has been studied as a function of its degree of rolling. It is concluded that the absorption of H_2 by Al comprises an irreversible absorption occurring during the electrodeposition of the metal, and a reversible dissolution which occurs only in the molten metal and increases with rising temp. The liberation of this gas owing to supersaturation gives rise both to porosity in castings and to the formation of bubbles during rolling. The solubility of H_2 in molten Mg is slightly > in the solid and also increases with rising temp.

J. W. S.

Solubility of quartz and silicates. C. C. LUCAS and M. E. DOLAN (Canad. med. Assoc. J., 1939, **40**, 126—134).—H_2O, salt solutions, urine, and blood serum dissolved small amounts of SiO_2 from quartz. The apparent solubility of quartz was usually ≫ its real solubility because of impurities. The action of H_2O and aq. solutions in general on silicates is not one of simple dissolution but of differential leaching; usually base is removed, leaving a residue richer in SiO_2.

R. L. N.

Significance of the cation and anion in processes of solvation and dissolution in liquid ammonia. B. B. VASSILIEV, M. A. PORTNOV, and A. M. SHURAVLEV (J. Gen. Chem. Russ., 1939, **9**, 65—68).—The solubility of K halides in liquid NH_3 rises with increasing anionic radius. That of alkaline-earth nitrates rises with increasing cationic radius at >40°, whilst at <0° the reverse is the case.

R. T.

Ageing and co-precipitation. XXVI. Co-precipitation of silver chloride with colloidal and flocculated silver bromide. I. M. KOLTHOFF and F. T. EGGERTSEN (J. Amer. Chem. Soc., 1939, **61**, 1036—1040).—When $AgNO_3$ is added to a mixture of Br′ and Cl′ ions (KBr, NaCl) so that the ppt. remains in colloidal solution, a homogeneous distribution of the halides is found between solid and liquid phases. When $AgNO_3$ is added so that the ppt. is immediately flocculated, heterogeneous mixed crystals are formed. With decreasing speed of addition of $AgNO_3$ the distribution approaches the expression of Doerner and Hoskins (cf. A., 1925, i, 381) but does not equal it. This is due to the ageing of the ppt. during the slow pptn., with the tendency to formation of homogeneous mixed crystals. When no flocculation occurs, the speed of addition and the amount of Ag added do not affect the distribution, which becomes instantaneously homogeneous. The speed of exchange between the colloidal particles and the solution is very great, is unaffected by ageing, and is attributed to great thermal mobility of the Ag⋅ and Br′ ions in the colloidal particles of AgBr. The distribution coeff. of the Br′ ion between solid and solution, and the co-pptn. of the Cl′ ion with AgBr, decrease with increasing temp. of pptn.

W. R. A.

Cation exchange in clay minerals.—See B., 1939, 604.

Negative diffusion of chloride [ions]. U. H. PURANEN (Suomen Kem., 1939, **12**, A, 69—70).—The complete diffusion of Cl′ from old ink marks into the unmarked paper, leaving the marks free from Cl′ (Hees, Arch. Kriminol., 1935, **96**, 13; 1937, **101**, 7), can be explained by the Donnan equilibria. It is due to the mobility of H⋅, Na⋅, and Cl′, and the relative immobility of SO_4''.

M. H. M. A.

Adsorption of hydrogen on poisoned nickel. II. S. IIJIMA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 382—391).—The adsorption velocity and the amount of H adsorbed on reduced Ni poisoned with C_2N_2, CO, or Hg at 20° have been determined. The equation for the velocity of adsorption previously suggested (A., 1939, I, 139) holds good in these cases also, but the adsorption velocity coeff. decreases as the amount of poison increases. There is a linear relationship between the log of the velocity coeff. and the quantity of poison. A poison combines first with those parts of the Ni where instantaneous adsorption takes place. The adsorption velocity curve changes its form as the amount of poison increases.

A. J. M.

Adsorption of nitrogen on reduced nickel. S. IIJIMA (Rev. Phys. Chem. Japan, 1939, **13**, 42—48). —The adsorption of N_2 on reduced Ni at temp. between −183° and 0° has been studied. Equilibrium is attained very rapidly, and adsorption and desorption are reversible. The amount adsorbed increases steadily with decreasing temp., and the heat of adsorption calc. from the curves is 3500 g.-cal. Langmuir's equation is not applicable; at the higher temp. Henry's law holds, and at the lower temp. the Freundlich equation. The adsorption is of the van der Waals type.

F. J. G.

Carbon as adsorbent. V. SIHVONEN and U. HEMMING (Suomen Kem., 1939, **12**, B, 11—14).—Activation of C increases the no. of active points by disintegration of the graphitic structure, but only atoms on the surface of the graphite layers give reversible adsorption. Atoms on the edges give irreversible adsorption due to combination of the adsorbent with their free valencies. With graphite (I), birch charcoal (II), and sugar charcoal (III), the active edges of which are permanently deactivated by pre-treatment with O_2, the mol. heats of ad-

sorption of CO_2, H_2, and O_2 increase in the order (I) < (III) < (II). The heat of absorption of CO_2 decreases with increasing absorption on (I) on (III), but not on (II), owing to its fibrous structure. The speed of absorption of CO_2 on (III) is unaffected by addition of Ag or Fe_2O_3 and depends only on the rate of diffusion of the gas into the pores. The heat of desorption of CO_2 from (III) increases rapidly with falling temp. due to capillary condensation at low temp., but with (I) or Fe_2O_3 the heat of desorption is independent of temp. M. H. M. A.

Sorption of phosphorus trichloride by active charcoal. K. ARII, M. KAWABATA, and T. TAKAI (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 356—367).—The sorption of PCl_3 by sugar C activated by heating at 900° for 2 hr. has been determined by a static method. The sorption isotherms, determined at 20°, 30°, and 50° at pressures < 1 atm., agree well with $a = xp^n$, the vals. of x and n being 22·945 and 0·2255 at 20°, 16·260 and 0·2540 at 30°, and 6·427 and 0·3300 at 50°, respectively (a = amount sorbed in mg. per g. of C, and p = equilibrium pressure in cm.). Empirical equations for the relation between the equilibrium pressure and the temp. for const. amount sorbed are calc. The relation between the amount sorbed and the temp. for const. pressure is of the form $a = a_0 - k\theta$ (a_0 = amount sorbed at 0°). The general equation connecting a (mg.), p (cm.), and θ (°C.) is $a = a_0 - kp^m\theta$ ($k = 0.5735$, $m = 0.15825$). A. J. M.

Heats of adsorption of gases on oxides of manganese at low pressures and room temperature. W. E. GARNER and T. WARD (J.C.S., 1939, 857—864).—The heats of adsorption of CO, CO_2, H_2, and O_2 on Mn oxides at various stages of oxidation between Mn_3O_4 and Mn_2O_3 have been determined. With all four gases, the area of surface available for adsorption is independent of the degree of oxidation, but the heat of adsorption on partly reduced surfaces is ≫ on fully reduced or fully oxidised surfaces. With CO, the adsorption is followed by a slow evolution of heat and the saturated surface has an increased adsorptive power for O_2. A mechanism is suggested whereby van der Waals adsorption of CO is followed by the formation of a CO_3'' ion, with production of a point of unsaturation on the surface. F. J. G.

Heat of adsorption of gases on chromium sesquioxide at low pressures and room temperatures. D. A. DOWDEN and W. E. GARNER (J.C.S., 1939, 893—902).—The heats of adsorption at 18° of CO, CO_2, H_2, and O_2 on oxidised and reduced surfaces of Cr_2O_3 have been determined. The adsorbing surface of the reduced substance is ≫ that of the oxidised substance. The adsorption of CO produces unsaturation of the surface (cf. preceding abstract) which results in an increased adsorptive capacity for O_2. H_2 is very firmly held by the oxidised material, but it does not produce unsaturation of the surface and this can be interpreted by means of a mechanism involving the production of adjacent pairs of OH groups with adjacent pairs of unsaturated points the unsaturation of which can disappear with evolution of heat. The results are compared with those of

Garner and Veal for adsorption on ZnO,Cr_2O_3 (A., 1935, 1457). F. J. G.

Adsorption of ethyl iodide on a plane surface of iron at 20°. (MISS) M. H. ARMBRUSTER and J. B. AUSTIN (J. Amer. Chem. Soc., 1939, **61**, 1117—1123). —The adsorption of EtI on a plane surface of cold-rolled steel after degreasing (i), and after degreasing and subsequent reduction in H_2 at 450° (ii), has been measured from 10^{-6} to 1 mm. pressure at 20°. The adsorption isotherms follow the Langmuir and the Palmer relations for middle pressures only; the pressure range valid for (i) is > for (ii). Force-area curves for the 2 surfaces are different : that for (i) resembles the curves for insol. films on H_2O with a break at ~30 sq. A. per mol., whilst that for (ii) shows no break. On (i) the intermol. forces are probably predominantly the van der Waals type, whilst on (ii) dipole repulsion seems to be the prime factor. The mol. heats of adsorption are : (i), 12,200 g.-cal.; (ii), 11,800 g.-cal. The bearing of the results on the action of inhibitors is discussed. W. R. A.

Adsorption on heteropolar surfaces. A. CLARK and B. D. THOMAS (J. Physical Chem., 1939, **43**, 579 —588).—The heats of wetting of CaF_2 and $PbSO_4$ by H_2O, MeOH, EtOH, Pr^aOH, Bu^aOH, and $Pr^\beta OH$ are zero. It is possible that the salts form hydrates or alcoholates which prevent further adsorption of liquid. The heats of wetting of SiO_2 gel and $BaSO_4$ decrease in ascending the homologous series of alcohols. A general theory of adsorption of dipoles on heteropolar surfaces is presented. C. R. H.

Adsorption of complex ammonia ions on silica gel. G. W. SMITH (J. Physical Chem., 1939, **43**, 637—646).—The adsorption isotherms for complex ammines of Ag, Ni, Cu, and Zn and mixtures thereof on SiO_2 gel have been determined. Adsorption decreases in the order Zn > Cu ≫ Ni > Ag. The Freundlich isotherm is applicable. The adsorption of each component of a mixture depends on the adsorption characteristics of the other components, i.e., it is decreased in presence of highly adsorbable ions. Knowledge of these characteristics enables the behaviour of any mixture to be predicted with fair accuracy. C. R. H.

Electrolyte adsorption and activity coefficient. I. Adsorption of acids on charcoal. W. OSTWALD (Kolloid-Z., 1939, **87**, 128—149).—Examination of published data for the adsorption of aq. acids on charcoal reveals a simple relation between the activity coeff. (f) of the solution of equilibrium and that of the adsorbed solution in the case of strong acids. If c denotes initial mol. concn., and $c - x$ the concn. at equilibrium, the expression $f_{\pm}^{\pm} = af_{c-x}^{\pm} + b$, in which a and b are const., is valid for HCl and H_2SO_4 over the ranges 0·005—1·5M. and 0·004—0·45M., respectively, and at different temp. between 0 and 85°. If f^+ instead of $f^{\pm}$ vals. are used, a and b are the same for HCl as for H_2SO_4. The relation does not hold for weak acids. In some cases departure from linearity occurs at extreme concn. vals., and for such cases a more general formula with three consts. is given. F. L. U.

Combination of electrophoretic and chromatographic adsorption methods. H. H. STRAIN (J. Amer. Chem. Soc., 1939, 61, 1292—1293).—Resolution of mixtures of H_2O-sol. compounds on Tswett adsorption columns is facilitated by application of an electrical potential to the ends of the columns. The combination of the chromatographic and electrophoretic methods enhances and extends the utility of both for the isolation of pure substances from mixtures. Operational details for the separation and isolation of coloured substances using the electrophoretic adsorption column are given. W. R. A.

Oxide films on metals. I. P. D. DANKOV and N. A. SCHISCHAKOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 1225—1248).—Electron diffraction study of oxide films on Fe shows that above 200° the film is a mixture of crystals of γ-Fe_2O_3 and Fe_3O_4 and that at $\sim$350° the crystals orient themselves in relation to the metal surface. When O_2 penetrates into the metal lattice there is only a min. change in the form and parameters of the initial lattice, and the cryst. structure of the oxide forming on the surface is therefore similar to that of the metal. In this respect Fe behaves similarly to Al, Cr, Zn, Ni, Cu, and Mg. When marked differences occur in the form or parameters of the metal lattice and its normal oxide, surface oxidation leads to the formation of new unstable forms of the oxide. F. H.

Higher-order transformations in unimolecular layers. D. DERVICHIAN and M. JOLY (Compt. rend., 1939, 208, 1488—1489; cf. A., 1938, I, 190).—The area per mol. corresponding with an ordinary phase transformation (cf. A., 1938, I, 27) in a unimol. layer also corresponds with a higher-order discontinuity in a phase existing in a higher-temp. region. Higher-order discontinuities are characterised by anomalies in the variation of η and the apparent electric moment in the film, and they are often related to the steric properties of the C chains in the mols. Their occurrence in fatty acid and triglyceride layers for areas of 19·5, 20·5, 22, 23·5, 24·5—27, and 38 sq. A. per C chain is discussed. A. J. E. W.

Pressure–area relations of fatty acid and alcohol monolayers. G. C. NUTTING and W. D. HARKINS (J. Amer. Chem. Soc., 1939, 61, 1180—1187).—Pressure–area relations have been determined for monolayers of 7 fatty acids (14—20 C atoms per mol.) at 25°, and of 5 alcohols (14—18 C per mol.) at 20°, on $0·01N$-H_2SO_4. The expanded films of myristic and pentadecoic acids show (i) great and rapidly-changing compressibility, both above and below the kink point, (ii) large areas at zero pressure, and (iii) perfect coincidence of the curves below the kink point of pentadecoic acid. The mol. area in the condensed liquid acid films decreases with the length of the hydrocarbon chain. The limiting areas at zero film pressure (F_0) for the acids (17—20 C) are 24·59, 24·41, 24·00, and 23·64 sq. A., respectively. The van der Waals energy, therefore, increases with chain length, and draws the mols. closer as intermol. attraction increases. In the solid plastic state the chains are so closely packed that the corresponding effect is small. F_0 for the alcohols at 20° is almost const. at 21·9 sq. A. for the hydrocarbon chains 14—18 C. The

areas of the liquid monolayers at higher pressures are thus determined by the compressibility of the films. The pressure of the transition point, liquid $\rightarrow$ plastic solid, increases from 6·2 for 14 C to 12·2 dynes per cm. for 18 C in the alcohols at 20°; the corresponding change for the acids at 25° is from 21 (15 C) to 20 dynes per cm. (19 C). W. R. A.

Built-up films of unsaturated and substituted long-chain compounds. A. E. ALEXANDER (J.C.S., 1939, 777—781).—Built-up multilayers of a no. of long-chain compounds, viz., cis- and trans-unsaturated acids, α-substituted acids, and C_6H_6 derivatives, have been studied, and the optical thickness per layer compared with the X-ray spacing. The bromination of the multilayer of a C_6H_6 derivative was successful, but the multilayers of the Ca salts of unsaturated acids were completely disrupted by Br vapour. F. J. G.

Molecular interaction in monolayers. Association between amines and organic acids. E. G. COCKBAIN and J. H. SCHULMAN (Trans. Faraday Soc., 1939, 35, 716—727; cf. A., 1939, I, 256).—Reactivities of org. acids present in the solution underlying monolayers of $Me \cdot [CH_2]_{17} \cdot NH_2$ have been determined by comparing the concns. at which they affect the surface pressures (F) and surface potentials of the films. Acids containing few acidic groups and a small non-polar residue react weakly and are readily displaced by increasing F, forming then an adsorbed layer which increases the stability of the amine film. Substances like tannic acid or purpurogallin, containing numerous acidic groups, are strongly adsorbed and impart to the amine film a rigid structure which collapses in compression. The adsorption is sensitive to p_H. The various types of interaction between monolayers and underlying solutes are discussed. F. L. U.

Interaction between adsorbed substances of simple constitution, and insoluble monolayers. N. K. ADAM, F. A. ASKEW, and K. G. A. PANKHURST (Proc. Roy. Soc., 1939, A, 170, 485—500).—The changes of surface pressure and potential which occur when monolayers are formed on solutions of Bu^aOH, $PrCO_2H$, and $PhOH$ of varying concn. are investigated. At low surface pressures penetration of the film takes place, turning a normally coherent film into a vapour-expanded or gaseous one. When the film is compressed penetration diminishes or ceases. G. D. P.

Films at the liquid/liquid interface. I. **Experimental.** A. E. ALEXANDER and T. TEORELL (Trans. Faraday Soc., 1939, 35, 727—737).—The ring method is the most satisfactory for the study of films at a liquid–liquid interface. Procedure is described in detail. Experimental F–A (force-area) curves for gliadin, serum-albumin, lecithin, lysolecithin, and Na cetyl sulphate at the C_6H_6–H_2O interface fit an equation of the type $(F - F_0)(A - A_0) = $ const. Transition from the air–H_2O to the oil–H_2O interface almost removes the F_0 term but has little effect on A_0. At low pressures all the films are much more expanded than at the air–H_2O interface, but approximate to the vals. for the latter at high pressures. F. L. U.

Motion of molecules at phase boundaries. H. FLOOD (Tids. Kjemi, 1939, **19**, 53—57).—A review.
                                                          M. H. M. A.

Surface tension of saponin solutions. A. BOUTARIC and (MLLE.) P. BERTHIER (Bull. Soc. chim., 1939, [v], **6**, 804—811).—The effects of concn. and time of keeping on the surface tension (γ) of saponin solutions have been investigated. The presence of electrolytes generally increases the lowering of γ produced by the saponin, the effect being the greater the lower is the valency of the cation present. $ThCl_4$, however, causes an increase in the γ of saponin solutions. The reduction of γ produced by saponin passes through a max. at p_H 3—4, but its val. depends considerably on the nature of the buffer solutions used.
                                                          J. W. S.

Surface activity. II. Geometrical isomerides. A. GIACALONE (Gazzetta, 1939, **69**, 198; cf. A., 1939, I, 317).—The surface activity of fumaric acid is > that of maleic acid, whereas the activity of citraconic acid is > that of mesaconic acid. The geometrical arrangement of the surface-active mols. in the H_2O surface is discussed.   O. J. W.

Effect of electrolytes upon the interfacial tension between water and dekalin (*trans*-decahydronaphthalene). W. L. GUEST and W. C. M. LEWIS (Proc. Roy. Soc., 1939, **A**, **170**, 501—513).—The interfacial tension (γ) was determined by the drop-vol. method. The effect of varying concn. of KCl, LiCl, $BaCl_2$, $LaCl_3$, $AlCl_3$, KI, KCNS, LiI, and LiCNS in H_2O solution was measured. γ falls with increasing concn. of the last four salts; no theoretical explanation of this behaviour is available. The γ–concn. curves for dil. LiCl and $LaCl_3$ exhibit min. followed by a rise of γ above the val. for a H_2O-dekalin interface. A theoretical explanation of the min. is given.   G. D. P.

Surface energy of mixtures of finely divided carbon and paraffin. R. S. BRADLEY (J. Physical Chem., 1939, **43**, 663—669).—The surface tension of mixtures of lamp-black (d 1·66, mean radius of particles 4·5 × 10^{-5} cm.) and paraffin has been measured at 21°. The large increase in surface energy which occurs is discussed on the basis of the author's theory for the cohesive forces between solid particles.
                                                          C. R. H.

Critical considerations on the wetting of capillaries by liquids. I. R. LOMAN (Chem. Weekblad, 1939, **36**, 337—341).—The theory that the direct source of the rise in a capillary is the adhesion tension is adversely criticised both from the combined vectorial balance and Laplace viewpoint and also from considerations of surface energy. The non-spreading property of oleic acid and its low capillary rise in contrast with non-polar liquids are explained on the hypothesis that the mols. are attached to the solid surface by the polar group.   S. C.

Quantitative transfer of aqueous solutions. R. BALLENTINE (Science, 1939, **89**, 301—302).—Non-wettable surfaces on glass are prepared by treatment with 0·25-saturated Fe^{III} stearate (I) in C_6H_6, draining, and allowing the solvent to evaporate. The thin coating of (I) thus obtained is preferable to one of paraffin, and is unattacked by 0·1N-HCl, 0·1N-

NaOH, saturated NaCl, light petroleum, $CHCl_3$, and Et_2O after 30 min. exposure. It does not absorb methylene-blue or interfere with respiration or dye-reduction systems. It can advantageously replace paraffin in coating micro-capillaries.   L. S. T.

Determination of pore size of [porous] ceramic and glass filters with air–liquid and liquid–liquid systems. R. SCHNURMANN (Kolloid-Z., 1939, **87**, 127—128).—Some inferences drawn by Knöll (A., 1939, 1, 140) are criticised.   F. L. U.

Nature of foam. V. Phase inversion and foam formation in an emulsion of acetic acid, benzene, and water. T. SASAKI (Bull. Chem. Soc. Japan, 1939, **14**, 107—114).—The heterogeneous region of this system can be divided according to the type of emulsion produced by two different methods of shaking. The first region produces H_2O-in-oil and the second oil-in-H_2O emulsions whilst the third may give both and may be foamy or non-foamy according to the method of shaking. These differences have been studied and are discussed in detail.   T. H. G.

Colloid chemical investigations of three-component liquid systems. III. Emulsification of systems in which both liquid phases have the same specific gravity. N. SATA and H. OKUYAMA (Bull. Chem. Soc. Japan, 1939, **14**, 135—139).—The vals. of η for the aq. and non-aq. layers and the interfacial tensions γ' have been measured for certain systems. They are : 1·00, 0·75, and 36·6, respectively, for the system H_2O-C_6H_6-CCl_4; 1·09, 2·03, and 11·4 for H_2O-*iso*-C_5H_{11}·OH–$CHCl_3$; 1·29, 2·76, and 3·6 for H_2O-MeOH–C_6H_6 (no units are recorded). The rates of emulsification and coagulation depend on the relative amounts of the two phases present. With approx. equal amounts emulsification is very easy in all cases whilst the rate of coagulation increases with γ'. With only a small amount of one phase emulsification is much more difficult and supersonic waves have been used. It is found that the resulting dispersions are very fine and their stability increases with γ'.   T. H. G.

Formation and stability of emulsions.—See B., 1939, 626.

Ultramicroscopy in optically anisotropic crystals. H. EKSTEIN (Bull. Soc. Franç. Min., 1938, **61**, 284—290).—Theoretical.   L. S. T.

Depolarisation of light by coarse suspensions. A. BOUTARIC and (MLLE.) J. BRETON (J. Phys. Radium, 1939, [vii], **10**, 176—180).—The depolarisation produced when polarised light is passed through coarse suspensions (the Procopiu phenomenon) has been studied with suspensions of bentonite, starch, albumin, gelatin, gum arabic, cellulose, amber, NaCl, C, and an emulsion of C_6H_6 in H_2O. A notable depolarisation is observed for all except suspensions of opaque particles (*e.g.*, C), and the coeff. of depolarisation is the product of the concn. of the suspension and the thickness of the column. The suspended particles need not necessarily be birefringent; depolarisation is manifest with non-absorbing particles when their optical density reaches a crit. val.
                                                          W. R. A.

Disperse structure and contamination of solid systems. D. BALAREV (Kolloid-Beih., 1939, **50**, 1—234).—A monograph. F. J. G.

Viscosity of colloids. I Anomalous viscosity of dilute suspensions of rigid anisometric particles. J. R. ROBINSON (Proc. Roy. Soc., 1939, A, **170**, 519—550).—Experiments were carried out on dil. suspensions of tobacco mosaic virus protein and of mercurisulphosalicylic acid. Simultaneous measurement of the optical double refraction and the viscous behaviour of the suspensions shows that the particles become more oriented with increasing rates of shear. As the rate of shear increases the viscosity falls to that of the solvent. The overall viscosity exceeds that of the solvent because energy is dissipated by the disturbance of the field of flow of the solvent by the precessional motion which it imposes on the particles. The nature of the anomalous viscosity is discussed. G. D. P.

Calculation of approximate particle sizes in stratified alumina hydrosols. M. A. MILLER (J. Physical Chem., 1939, **43**, 631—636).—Calculations based on the rate of stratification give results of the correct order of magnitude. The application of Stokes' law and the equations of Perrin and of Odén concerning colloidal suspensions to stratifying systems is discussed. C. R. H.

New magnetic–optical reaction. Q. MAJORANA (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 11—14).—The light absorption of $Fe(OH)_3$ sols in a magnetic field has been studied by a photo-electric method. Variations in the light absorption, which are probably related to the degree of orientation or deformation of the colloidal particles, are observed with different directions of the light beam relatively to the direction of the magnetic field. O. J. W.

Diffusion of long-chain sulphonic acids. E. L. McBAIN (Proc. Roy. Soc., 1939, A, **170**, 415—423).—The diffusion coeff. of the soap-like long-chain acids, C_{10} to C_{14}, exhibits a sharp min. in dil. solutions followed by a rise to a higher val. as the concn. increases. The results are interpreted as indicating the presence of both a neutral micelle and an ionic micelle. G. D. P.

Peptisation and complex formation in non-aqueous soap solutions. A. S. C. LAWRENCE (Trans. Faraday Soc., 1939, **35**, 702—706; cf. A., 1938, I, 356).—The gelation temp. of Nujol solutions of Na and Ca stearates is lowered by addition of fatty acids, H_2O, phenols, and alcohols, the effect decreasing in this order. The peptising action is due to fatty acid (HFa), whether added as such or liberated by another substance. Evidence for the existence of complexes of both soaps with HFa is presented. F. L. U.

Effect of ultrasonic waves on colloid phenomena. VI. Influence on rotatory power of high-molecular colloidal substances. I. Gelatin solutions. N. SATA (Kolloid-Z., 1939, **87**, 186—190; cf. A., 1939, I, 142).—Ultrasonic waves produce in 0·75% gelatin sols (1) a rapid decrease in the initial rotation which is recovered on keeping, and (2) a slower irreversible decrease. Uninterrupted irradi-

ation causes the equilibrium val. of the rotation to fall to a min. const. val. in 11—12 days. The first effect is attributed to a reversible dehydration, and the second to depolymerisation. Long-continued irradiation produces chemical changes accompanied by darkening, turbidity, and a large decrease in viscosity. F. L. U.

Silica gels from various acids. Effect of concentration and mixtures on setting time. H. L. DAVIS and K. D. HAY (J. Amer. Chem. Soc., 1939, **61**, 1020—1023).—SiO_2 gels, produced by mixing Na_2SiO_3 with varying concns. of HCl, H_2SO_4, H_3PO_4, and AcOH, set in a min. time when the final system is at p_H 8. Deviations from p_H 8 (acid and alkaline sides) cause a sharp rise in the setting time t, except with the weaker acids where a buffer action is probably partly responsible for their lesser peptisation. A small excess of HCl causes t to rise sharply to a max. For the mixtures H_2SO_4–HCl and H_2SO_4–AcOH, the total acid normality being const., t is not a linear function of the composition of the mixtures. By addition to Na_2SiO_3 of acid of increasing concn. the following types of systems are produced : stable alkaline negative SiO_2 sols, rapidly setting gels, stable acid positive SiO_2 sols, and finally a second series of gels in conc. acid systems. W. R. A.

Dextrin and starch sols charged with phosphoric, sulphuric, and organic acid groups. J. SZPER and S. SZPER (Trans. Faraday Soc., 1939, **35**, 667—674).—The prep. of sols of starch and dextrin containing only one of the ionogenic groups $\cdot PO(OH)_2$, $\cdot SO_3H$, and $\cdot CO_2H$ is described, and analytical and electrochemical data are recorded. Autoclaving the original sols at 120° leads to loss of H_3PO_4 and to lactonisation of org. acid groups. F. L. U.

Behaviour of cellulose in alkaline solutions.—See B., 1939, 587.

Nitrocellulose sols.—See B., 1939, 585.

Ageing of cellulose nitrate in various media. K. KANAMARU (Kolloid-Z., 1939, **87**, 191—194).—When specimens of cellulose nitrate of 13·1, 12·8, and 12·6% N content are aged for periods up to 500 days in contact with air, CCl_4, light petroleum, C_6H_6, EtOH, and H_2O, the viscosities of their 1% solutions in $COMe_2$ show very little change for the non-polar media but considerable change for the polar. Measurement of the X-ray diagrams confirms the view that the polar liquids cause or permit a partial change from parallel to random orientation of the micelles. F. L. U.

Diffusion constants of proteins. A. POLSON (Kolloid-Z., 1939, **87**, 149—181).—Diffusion consts. (D) of 32 proteins, representing albumins, globulins, gliadins, hæmoproteins, and enzymes, have been determined by Lamm's method (A., 1929, 129). Preps. are described. Mol. wts. calc. from D agree well with those obtained with the ultracentrifuge. Sp. vols. and sedimentation consts. are calc. Change of D with concn. is most marked with proteins having the lowest mol. wt., decreasing as the latter increases; for proteins having mol. wts. $\sim 10^6$ D is independent of concn. F. L. U.

Genetic formation of materials. XI. Material formation in a gaseous medium. V. KOHL-

SCHÜTTER and K. DÜRRENMATT (Helv. Chim. Acta, 1939, **22**, 457—477; cf. A., 1939, I, 260, 271).—The formation of solid particles in a gaseous medium is discussed with particular reference to I, Zn, and Cd. The effects of the pressure and nature of the gas medium and of the material of the containing vessel on the cryst. forms produced have been investigated.
                     J. W. S.

Progressive change of colloidal solutions during flocculation. A. BOUTARIC and C. SARAC (Rev. Fac. Sci. Istanbul, 1939, **4**, 13—21).—The absorption coeff. (α) of a lyophobic sol undergoing slow coagulation, for light of a given kind, increases with time to a const. val. which corresponds with the completion of the action of the electrolyte, provided the liquid remains undisturbed. Stirring then produces immediate pptn. If the times (t) needed for the attainment of the limiting α in presence of decreasing concns. (c) of an electrolyte are plotted against c a curve is obtained which can be represented by $c = c_0 e^{k/t}$ (k = const.). Plotting log c against $1/t$ then gives a straight line from which the val. of c_0 for $1/t = 0$ can be obtained. c_0 represents the max. concn. of electrolyte to which the sol is completely stable, and its determination affords an exact quant. means of comparing the stability of a sol towards different electrolytes. Examples are given.   F. L. N.

Electrolyte coagulation of weakly solvated sols and electrolyte activity. XI. Influence of ion spreading. W. OSTWALD (Kolloid-Z., 1939, **87**, 199).—For reasons of priority, the " Buchner nos." referred to in the above paper (A., 1938, 1, 619) should be called " Bruins nos."   F. L. U.

Supersaturation and formation of Liesegang rings. III. A. VAN HOOK (Kolloid-Z., 1939, **87**, 125—127).—Previous measurements (A., 1939, I, 78) are in agreement with the expression log $x = an + b$ (n = no. of rings, x = distance, a and b const.), which can be derived from Jablynski's formula. The expression of Christiansen and Wulf (A., 1934, 955) is also applicable if the calc. instead of the observed val. of n is used.   F. L. U.

Liesegang periodicities obtained by attack of coarse solid suspensions in gelatin. (MLLE.) S. VEIL (Compt. rend., 1939, **208**, 1496—1498).—Liesegang rings have been obtained by depositing drops of $AgNO_3$ and K_2CrO_4 on the surface of suspensions of $ZnCrO_4$ and Ag_3BO_3, respectively, in gelatin. The periodic distribution of the Ag_2CrO_4 is reached by transport of the detached particles produced by attack of the suspended grains. Capillary forces at the interface of the pptd. phase and the surrounding medium play an important part in periodic pptn. phenomena.   A. J. E. W.

Direct photographing of electrophoresis diagrams. H. SVENSSON (Kolloid-Z., 1939, **87**, 181—186).—The method devised by Philpot for sedimentation curves (A., 1938, I, 215) has been modified and applied to electrophoresis. Photographs are given to illustrate the direct quant. analysis of a mixture of albumin and globulins.   F. L. U.

Electro-osmosis in gelatin gels before and after treatment with formaldehyde. J. SWYNGE-DAUW (Compt. rend. Soc. Biol., 1939, **130**, 468—470).—Very little difference is observed in the electro-osmosis of acid gels after the addition of CH_2O. On the alkaline side of the isoelectric point, CH_2O decreases the dissociation const. of groups reacting with alkali.   H. G. R.

Measurement and statistical calculation of the equilibrium $D_2 + H_2S \rightleftharpoons H_2 + D_2S$. D. GRAFE, K. CLUSIUS, and A. KRUIS (Z. physikal. Chem., 1939, **B**, **43**, 1—19).—The equilibrium consts. of the reversible reactions $3H_2S + 2Bi \rightleftharpoons 3H_2 + Bi_2S_3$ (k_1) and $3D_2S + 2Bi \rightleftharpoons 3D_2 + Bi_2S_3$ (k_2) have been determined at various temp. between $350°$ and $600°$ in an apparatus which is described. The equilibrium const. of the reaction $D_2 + H_2S \rightleftharpoons H_2 + D_2S$ is k_1/k_2. The heat of reaction is 885 ± 45 g.-cal. experimentally and 800 ± 80 g.-cal. by the statistical treatment of spectroscopic data.   W. R. A.

Magnetic study of the equilibrium between ferrohæmoglobin, cyanide ion, and cyanide ferrohæmoglobin. F. STITT and C. D. CORYELL (J. Amer. Chem. Soc., 1939, **61**, 1263—1266).—A new stable compound of ferrohæmoglobin (I) with cyanide is obtained by adding a large amount of KCN to a solution of (I) alkaline enough to prevent formation of HCN. The absorption spectrum shows a fairly narrow band max. at ~5610 A., a min. at ~5500 A., and a second max. at ~5335 A. Magnetic measurements were made by adding successive amounts of KCN solution to a solution of (I) buffered at p_H ~10·6, and determining the susceptibility at each step. It is concluded that cyanide ferrohæmoglobin is diamagnetic, with essentially covalent octahedral co-ordination about the Fe atoms, and is thus similar in structure to oxyhæmoglobin and carboxyhæmoglobin, the spectra of which it closely resembles.
                     W. R. A.

Association of ions in a bi-univalent electrolyte. A. R. MILLER (Trans. Faraday Soc., 1939, I, 691—697).—Mathematical. Ionic distribution functions are derived, which lead to a picture consistent with the results of conductivity measurements.
                     F. L. U.

Dissociation constant of hypobromous acid. M. KIESE and A. B. HASTINGS (J. Amer. Chem. Soc., 1939, **61**, 1291).—The dissociation const. of HOBr, obtained by potentiometric titration, is $1·0 \times 10^{-9}$.
                     W. R. A.

Acidity potential as a measure of the free energy of protolytic reactions. E. WIBERG (Congr. int. Quim. pura apl., 1934, **9**, II, 323—333; Chem. Zentr., 1936, ii, 3768).—Proton transfer is considered as being promoted by a difference of potential between acid and base. On this basis, acids and bases can be arranged in a potential series. The calculation of the potentials (that of H_2O being taken as zero) is described, and the use of the conception is illustrated.   A. J. E. W.

B.p. elevation. III. Sodium chloride, 1·0 to 4·0M. and 60° to 100°. R. P. SMITH and D. S. HIRTLE (J. Amer. Chem. Soc., 1939, **61**, 1123—1126).—Activity coeffs., osmotic coeffs., and partial mol. heat content data have been determined and are

discussed and compared with existing vals. calc. from e.m.f. measurements. W. R. A.

Binary mixtures. Calculation of partial vapour pressures from the total pressure. C. G. BOISSONNAS (Helv. Chim. Acta, 1939, 22, 541—547).—The author's method (cf. A., 1938, I, 186) is applied to the calculation of the partial pressures of the components from the v.p.-composition curves for the systems H_2O–EtOH at 25° and EtOH–$CHCl_3$ at 45°. J. W. S.

Two-phase equilibrium in binary and ternary systems. I. System methane–ethane. M. RUHEMANN (Proc. Roy. Soc., 1939, A, 171, 121—136).—Thermodynamic formulæ are derived for the equilibrium of a binary liquid with its vapour. Pressure-composition curves have been determined for CH_4–C_2H_6 at temp. between 0° and —104° at pressures up to 100 atm. Temp.-composition curves are computed. Up to 15 atm. the mixtures show only small deviations from perfect solutions. G. D. P.

Physical properties of hydrocarbons and their mixtures. E. R. GILLILAND, R. V. LUKES, and H. W. SCHEELINE (Amer. Inst. Min. Met. Eng., 1939, Tech. Publ. 1060, 16 pp.; Petroleum Tech., 2).—Vapour–liquid equilibria data for C_3H_8–*iso*butylene mixtures have been obtained with the equilibrium still and the resulting curves compared with those calc. from fugacities and Raoult's law. The effect of pressure on the enthalpy of C_6H_6 and n-C_7H_{16} has been measured with an isothermal expansion unit, which is described. D. F. R.

Vapour pressure in the system NO–NO_2. D. A. EPSCHTEIN and L. A. TSCHIRKOVA (J. Appl. Chem. Russ., 1939, 12, 14—16).—V.p.-temp. curves are given for 5—38% solutions of NO in NO_2 at 20—60°. R. T.

Equilibrium pressure of a vapour in presence of the corresponding solid. F. CERNUSCHI (Anal. Asoc. Quím. Argentina, 1938, 26, 263—264).—A formula is deduced by the author's method (cf. A., 1938, I, 189). F. R. G.

Variation of composition of the eutectic ice + potassium nitrate [caused] by addition of electrolytes. H. J. MULLER (Bull. Soc. chim., 1939, [v], 6, 890—893).—Electrolytes which have one ion in common with KNO_3 and give the same initial lowering of the H_2O–KNO_3 eutectic (A., 1938, I, 622) have very different effects on the composition of the eutectic mixture. Analogous or isomorphous series of K salts (KCl, KBr, and KI, and K_2SO_4, K_2SeO_4, and K_2CrO_4) at low concn. depress the solubility of KNO_3 at the eutectic temp. almost equally. J. W. S.

Equilibrium of magnesium chloride and of carnallite melts with oxygen. W. D. TREADWELL and A. COHEN (Helv. Chim. Acta, 1939, 22, 433—449).—The equilibrium $MgCl_2 + 0.5O_2 \rightleftharpoons MgO + Cl_2$ has been investigated at 550—712° by circulation and streaming methods, and is expressed by $\log (p_{Cl_2}/p_{O_2}^{\frac{1}{2}}) = -1560/T + 2.17$. The equilibrium const. is lowered by the presence of KCl, vals. for mixtures containing 0.5, 1, and 2 mols. of KCl per mol. of $MgCl_2$ initially present being recorded. The

results are in accord with Berthelot's vals. of the heats of formation of $MgCl_2$, KCl, and $MgCl_2,2KCl$. Data are recorded for the d of various $MgCl_2$–KCl melts at 550—800°. J. W. S.

Dehydration of gypsum. W. BÜSSEM, O. COSMANN, and C. SCHUSTERIUS (Sprechsaal, 1936, 69, 405—406, 421—422, 433—434, 443—445; Chem. Zentr., 1936, ii, 3279).—The following cryst. phases of the system $CaSO_4$–H_2O occur : $CaSO_4,2H_2O$ (I); $CaSO_4,0.5H_2O$ (hemihydrate) (II); $CaSO_4$ (semi-anhydrite) (III); $CaSO_4$ (anhydrite) (IV). Included H_2O is evolved from (I) at >45°, with a max. rate of loss at 75°. (II) is formed at >95° [commercial and pptd. (I)] or 110° [dense mineral (I)]. (II) gives (III) at 150° (max. rate, 180°), and formation of (IV) commences at 230—250° and is complete at 400°. Sintering of natural (IV) begins at 450°, and is rapid at >500°. A. J. E. W.

Hydrolysis of zinc sulphate and formation of basic sulphate. H. HAGISAWA (Bull. Inst. Phys. Chem. Res. Japan, 1939, 18, 368—381).—The p_H of solutions of $ZnSO_4$ at various concns. at 25° has been determined with a glass electrode. The vals. obtained varied with the method of purification of the crystals, but concordant results were obtained with crystals deposited from a saturated solution on cooling from 70° to 0°, and with those obtained by pptg. a saturated solution with EtOH at room temp., both processes being carried out in an atm. of CO_2. The p_H varies with dilution (V) according to $p_H = 5.340 + 0.4417 \log V$. The hydrolysis of $ZnSO_4$ is best represented by $Zn^{\cdot\cdot} + H_2O \rightleftharpoons ZnOH^{\cdot} + H^{\cdot}$. The hydrolysis const. $K_h = [ZnOH^{\cdot}][H^{\cdot}]/[Zn^{\cdot\cdot}] = 6.5 \times 10^{-11}$. The potentiometric titration of $ZnSO_4$ with NaOH was also studied. When $[ZnSO_4]$ is >0.0074 g.-mol. per l. the ppt. has the composition $ZnSO_4,3Zn(OH)_2$. When the concn. is very small (0.0004955 g.-mol. per l.) the ppt. is $Zn(OH)_2$, and its solubility product is 3.4×10^{-16}. Variations in the solubility product of $Zn(OH)_2$ may be due to the different state of aggregation of the ppt. according to the conditions of prep. A. J. M.

Thermal study of fused mixtures of sodium metaphosphate and pyroarsenate. A. A. BOMBELLI (Anal. Asoc. Quím. Argentina, 1938, 26, 265—268; cf. A., 1939, I, 153).—The f.p.-composition curve for mixtures of $Na_4As_2O_7$ and $NaPO_3$ has a min. at 18% $Na_4As_2O_7$. There is no evidence of compound formation. F. R. G.

System manganese sulphide–calcium oxide at medium and high temperatures. D. MIREV (Arch. Eisenhüttenw., 1938—9, 12, 529—531).—Analysis of mixtures of MnS and CaO in the mol. ratios 2 : 1, 1 : 1, 1 : 2, and 1 : 3, after heating at 500—1600°, indicates that CaO not only reacts to form CaS but also combines chemically with the MnS and the MnO formed from it. At 500° part of the mixture reacts according to $CaO + MnS \rightleftharpoons CaS + MnO$, and simultaneously, to an extent $\propto$ the composition of the original mixture, the reactions $3CaO + MnS \rightarrow 3CaO,MnS$ and $2CaO + MnO \rightarrow 2CaO,MnO$ take place. In the molten state 3CaO,MnS decomposes but 2CaO,MnO does not. At temp. >1600° and with

sufficient excess of CaO, a complete transference of the S to CaS is possible : $3CaO + MnS \rightarrow 2CaO,MnO + CaS$.
C. E. H.

Thermal analysis of the system hydrazine-carbamide. V. I. SEMISCHIN (J. Gen. Chem. Russ., 1939, **9**, 83—85).—The eutectic is at $-31\cdot9°$ [$33\cdot7$ mol.-% $CO(NH_2)_2$]. Compounds are not formed.
R. T.

Determination of the constitution of non-isolable solid compounds ; solid potassium polyiodides in aqueous-alcoholic solutions. M. AUMÉRAS and A. RICCI (Bull. Soc. chim., 1939, [v], **6**, 849—864).—The composition of a solid constituent is deduced from the compositions of the mother-liquor and of the wet solid, and a knowledge of the proportions of mother-liquor and solid contained in the wet solid. In the system $KI–I_2–H_2O$ this has been achieved by addition of small amounts of EtOH, which is easily determinable both in the solution and in the wet residue by oxidation with CrO_3. Besides the compounds KI_3 and KI_7 previously observed, the system at 15° indicates the existence of the *compounds* $KI_4,(2H_2O\,?)$ and $K_2I_9,2$ or $3H_2O$.
J. W. S.

Nature of solid solutions of the glaserite and berkeite type. I. G. DRUSHININ (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 1141—1166).—Investigation of the systems $K_2CrO_4–Na_2CrO_4–H_2O$ and $K_2SO_4–Na_2SO_4–H_2O$ shows the existence of glaserites $K_3Na(SO_4)_2$ and $K_3Na(CrO_4)_2$ capable of forming isomorphous mixtures with the original components. Solid solutions of $K_3Na(SO_4)_2$ and Na_2SO_4 exist in the range $2\cdot44$—$3\cdot00$ atoms K per atom Na (25°). Solid solutions of $K_3Na(CrO_4)_2$ with K_2CrO_4 occur containing up to $3\cdot16$, and of $K_3Na(CrO_4)_2$ with Na_2CrO_4 containing down to $2\cdot39$, atoms K per atom Na. In the system $K_2CrO_4–Na_2CrO_4–Na_2SO_4–K_2SO_4–H_2O$, glaserites of complex solid solutions are obtained. In the systems $Na_2SO_4–Na_2CO_3–H_2O$ and $Na_2CrO_4–Na_2CO_3–H_2O$ the compounds $2Na_2SO_4,Na_2CO_3$ and $2Na_2CrO_4,Na_2CO_3$ are formed and mix isomorphously with their components, the ranges of solid solutions existing at 35° being $1\cdot48$—$2\cdot19$ mols. Na_2SO_4, and $1\cdot82$—$2\cdot08$ mols. Na_2CrO_4, per mol. Na_2CO_3, respectively. Crystals of $K_3Na(CrO_4)_2$ were obtained in a new trigonal form. Pptd. berkeite crystals consist of truncated bipyramids with a slightly developed rhombic prism. The conditions necessary for growth of the crystals are described.
F. H.

Systems sodium chloride–butyric acid–water, sodium chloride–*iso*butyric acid–water, and potassium *iso*butyrate–*iso*butyric acid–water at 25°. C. R. BURY and J. R. MENDS (J.C.S., 1939, 742—744).—Equilibrium data are given for the three systems, in comparison with data previously recorded for the system $Pr^\alpha CO_2Na–Pr^\alpha CO_2H–H_2O$ (A., 1935, 303). NaCl exerts the normal salting-out effect on both acids, but $Pr^\beta CO_2H$, like $Pr^\alpha CO_2H$, is salted-in by its alkali salt.
F. J. G.

System calcium selenate–ammonium selenate–water at 30°. R. C. WELTON and G. B. KING (J. Amer. Chem. Soc., 1939, **61**, 1251—1252 ; cf. A., 1938, I, 518).—The isotherm for the system $CaSeO_4–$

$(NH_4)_2SeO_4–H_2O$ has been determined at 30°. Two solid phases, $CaSeO_4,2H_2O$ and $(NH_4)_2SeO_4$, are present. The solubility curve showing solutions in equilibrium with $CaSeO_4,2H_2O$ is, unlike that for most ternary systems, convex towards the solid phase, indicating that the rate of decrease in solubility of $CaSeO_4$ increases with addition of $(NH_4)_2SeO_4$.
W. R. A.

Equilibrium studies on ore-forming sulphides. II. R. SCHENCK and P. VON DER FORST (Z. anorg. Chem., 1939, **241**, 145—157).—The method of isothermal reduction with H_2 has been applied to a study of the systems Ni–S, Ni–Sb–S, and Ni–Bi–S, and earlier work on the systems Sb–S and Bi–S has been corr. for the effects of thermal separation. The reduction of NiS is reversible, affording at 600° γ-mixed crystals having $\not> 43\cdot1$ at.-% S, which cannot be completely reduced to Ni. At 400° and 500° the solid phases Ni_6S_5, which is the upper limit of a short mixed-crystal series, and Ni_3S_2, which is not further reducible, are indicated. The 400° isotherms of the systems Ni–Sb–S and Ni–Bi–S are given. The solid phases NiSbS (ullmannite), NiSb (breithauptite), $NiSb_2$, and $Ni_3Bi_2S_2$ are indicated. Ni_4Sb_5 (cf. A., 1906, 361) does not exist. NiSbS is reversibly reducible to NiSb ; $Ni_3Bi_2S_2$ cannot be further reduced. At 450° there are indications that $NiBiS$ can exist as a metastable solid phase.
F. J. G.

Relationship of beryllium to the vitriol-forming group and the alkaline-earth metals. VI. IV. Double-salt formation between ammonium and beryllium sulphate in comparison with that of the vitriols. II. W. SCHRÖDER [with U. BECKMANN and W. AUSEL] (Z. anorg. Chem., 1939, **241**, 179—195).—The data previously given (cf. A, 1939, I, 81) represent a metastable equilibrium at >50°. The stable double salt above 52° is $BeSO_4,(NH_4)_2SO_4$. Corr. equilibrium diagrams are given.
F. J. G.

Proposal to redefine the thermodynamic temperature scale. W. F. GIAUQUE (Nature, 1939, **143**, 623—626).
L. S. T.

Thermochemistry of nitrogen compounds. M. BRUTZCUS (Compt. rend., 1939, **208**, 997—999 ; cf. A., 1939, I, 83).—Valency augmentation and ionisation energies for N, and energy vals. for N·H and C·N linkings, are considered.
A. J. E. W.

Thermodynamics of bi-univalent electrolytes. V. Heats of formation and entropies of certain zinc and cadmium halides. R. G. BATES (J. Amer. Chem. Soc., 1939, **61**, 1040—1044).—Using cells of the type $Zn(Cd)–Hg$ (2 phase)$|Zn(Cd)X +$ saturated solution$|AgX–Ag$ (X = halogen; ZnX anhyd. or xH_2O ; $CdX = CdBr_2,xH_2O$) the e.m.f. were measured from 5° to 48°. Thermodynamic data (ΔG_{298}, ΔH_{298}, ΔS_{298}) for the various cell reactions have been calc. The vals. (in parentheses) of $-\Delta G$, $-\Delta H$, and $-\Delta S$, respectively, for the formation of anhyd. salts from their elements are : $ZnCl_2$ (88,256 ; 99,280 ; 36·98) ; $ZnBr_2$ (74,089 ; 78,234 ; 13·90) ; ZnI_2 (49,928 ; 50,505 ; 1·94) ; $CdBr_2$ (70,270 ; 75,390 ; 17·18). Vals. of ΔH are in satisfactory agreement with thermochemical data. The entropies at 25° are : $ZnCl_2$, 25·94 ; $ZnBr_2$, 32·95 ; ZnI_2, 38·52 ; $CdCl_2$, 31·16 ;

$CdBr_2$, 32·02; CdI_2, 39·50. The transition temp. of $CdBr_2,4H_2O$ and $ZnBr_2,2H_2O$ are 36·00° and 33·22°, respectively. W. R. A.

Heat of formation and specific heat of molybdenum nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 321—328).—The mean sp. heat of Mo_2N has been determined over the ranges 0—99·7°, 0—305·3°, and 0—500·3°. The true sp. heat over these temp. ranges is given by $c = 0·0699 + 4·34 \times 10^{-5}\theta — 6·237 \times 10^{-8}\theta^2$. The heat of formation of Mo_2N calc. from this equation and the dissociation pressure at high temp. is 16,800 g.-cal. The relationship between the heats of formation of the nitrides of elements of groups V, VI, and VII and their at. no. is discussed. A. J. M.

Precision measurements of the heats of vaporisation of oxygen, hydrogen sulphide, phosphine, argon, carbonyl sulphide, methane, and monodeuteromethane. A. FRANK and K. CLUSIUS (Z. physikal. Chem., 1939, **B**, **42**, 395—421).—The details of a method for the precision measurement of heats of vaporisation (L) are given and sources and magnitudes of probable errors are considered. The following vals. of L (g.-cal. per mol.) are given : O_2, 1630·7; H_2S, 4680; PH_3, 3493; A, 1557; COS, 4534; CH_4, 2036; CH_3D, 2050. The mean error is $\pm 0·1\%$. Ascertained vals. are compared with recorded data. W. R. A.

Heat effect of partition between two phases. V. K. PERSCHKE and A. V. LAKEDEMONSKI (J. Gen. Chem. Russ., 1939, **9**, 110—113).—The heat effect U of distribution of AcOH between H_2O and $C_5H_{11}\cdot OH$ is given by $U = 568·2 — 5·2T + 0·00863T^2$, where T is the abs. temp. R. T.

Influence of electrical resistance of electrolytes on the form of the electrical lines of force. A. GLAZUNOV and A. KUKLA (Congr. Chim. ind. Bruxelles, 1935, **15**, II, 1023—1028; Chem. Zentr., 1936, ii, 1859—1860).—The electrolysis of aq. $CuSO_4$ between a flat Cu anode and a perpendicular Cu-plated Ag wire has been studied. The cathodic c.d. (as measured by the rate of Cu deposition) decreased rapidly with increasing distance (d) from the anode; in some cases the c.d. rose to a max. at a crit. d val., corresponding with formation of oxide in the deposit. A. J. E. W.

Electrical conductances of pure and mixed salt solutions in the temperature range 0° to 25°. R. W. BREMNER [with T. G. THOMPSON, and C. L. UTTERBACK] (J. Amer. Chem. Soc., 1939, **61**, 1219—1223).—The sp. and equiv. (Λ) conductivities of various solutions of salts occurring in sea-H_2O have been measured at 5° intervals from 0° to 25°. The data for NaCl and KCl at 25° agree with those of Shedlovsky et al. (cf. A., 1934, 1308). Temp. coeffs. (I) of Λ have been calc. for 20 solutions at each temp. (I) for $MgSO_4$ solutions differs greatly from those of NaCl, yet the addition of $MgSO_4$ to NaCl solutions shows no apparent effect on (I) of NaCl. The mixture equation of Van Rysselberghe and Nutting (cf. A., 1934, 967) has been successfully applied to NaCl–KCl solutions at 25°. W. R. A.

Transference numbers of sodium acetate in aqueous solution. D. J. LE ROY and A. R. GORDON (J. Chem. Physics, 1939, **7**, 314—315).—Extending previous work (cf. A., 1938, 1, 460) the transference nos. of aq. NaOAc (0·02—0·17N.) have been determined at 25°. The data are in close agreement with those of Longsworth (cf. A., 1935, 1078) and the Longsworth function $t_+^{o\prime}$ is linear up to 0·1N. only. W. R. A.

Effect of solubility of glass on behaviour of glass electrode. D. HUBBARD, E. H. HAMILTON, and A. N. FINN (J. Res. Nat. Bur. Stand., 1939, **22**, 339—349).—The solubility and swelling in buffered and in strongly acid and alkaline solutions of Corning 015 and other glasses have been examined at various temp. by an interferometer method, and compared with the departures from the linear p_H– e.m.f. relation of glass electrodes of the same materials. The solubility increases rapidly at p_H vals. $> 8·5$. Corning 015 swells slightly below p_H 7, but the swelling is restricted in strongly acid solutions. The p_H regions of marked change of solubility or swelling correspond closely with those where e.m.f. anomalies occur. Neither dissolution nor e.m.f. anomalies occur in aq. NH_3. Glasses that exhibit no changes in swelling in highly acid solutions show no e.m.f. anomalies in the same region. The effect of high concns. of $MgSO_4$ on the p_H of buffered solutions is due to restricted swelling of the glass. W. A. R.

Antimony electrode for determination of p_H. M. TAMAI (J. Biochem. Japan, 1939, **29**, 307—318).—The potential of the Sb electrode is not dependent only on p_H; it is reduced by tartaric, metaphosphoric, oxalic, and citric acids, H_2SO_4, H_3PO_4, and HNO_3 having a smaller, and HCl and AcOH a negligible, effect. This reduction in potential becomes increasingly smaller with increasing dilution, but is not affected by neutralisation of the acid with alkali. Other factors affecting the potential are described. F. O. H.

Reproducibility of silver–silver halide electrodes. J. K. TAYLOR and E. R. SMITH (J. Res. Nat. Bur. Stand., 1939, **22**, 307—314).—All Ag-Ag halide electrodes change in potential during the first few hr. after prep., the fresh electrodes acting as cathodes towards those previously aged in the solution. Aged electrodes are reproducible in e.m.f. to 0·02 mv. They are not affected by exposure to light, but the presence of O_2 disturbs the potential of Ag–AgCl and Ag–AgBr electrodes in acid solution, and of Ag–AgI electrodes in both neutral and acid solutions. The equilibrium potential is independent of the method of prep. of the electrode (thermal, electrolytic, or thermal –electrolytic) except for Ag–AgI electrodes, of which the thermal–electrolytic type is the most reliable. W. A. R.

Calomel electrode. Gouy's formula. Diffusion potentials. M. CHANOZ, G. FLORENCE, and P. PERROTTET (Arch. Phys. biol., 1935, **12**, 238—250; Chem. Zentr., 1936, ii, 1498).—The internal potential of the HgCl electrode and the determination and calculation (by Gouy's formula) of diffusion potentials (V_d) are discussed with reference to e.m.f. data for liquid-junction cells. Calc. V_d vals. are tabulated for

junctions of 4, 1, and 0·1N-KCl with HCl, KOH, K_2SO_4, Na_2SO_4, $CuSO_4$, NaCl, and KCl (4, 1, 0·1—10^{-6}N.). Discrepancies between calc. and experimental vals. occur for the junction 4N-KCl|xN-HCl, but $V_d = 0$ for $x = 0·001$—1. V_d for a junction MX|H_2O can be determined by e.m.f. measurements on the cell Hg–HgCl|KCl (saturated) |0·04—0·2N-MX|H_2O|KCl (saturated)|HgCl–Hg.   A. J. E. W.

Change of the solution tension of iron by mechanical force. L. GIULOTTO (Nuovo Cim., 1936, **13**, 220—226; Chem. Zentr., 1936, ii, 3642).— The potential of a 0·2-mm. Fe wire in aq. $FeSO_4$ shows a reversible linear increase with tension, E rising by ~3·7 × 10^{-4} v. for an added load of 1 kg.   A. J. E. W.

Electrode potentials of metals and alloys in ferric nitrate solution. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 329—342).— The order of electrode potentials of Mg, Mn, Zn, Cd, Fe, high-C steel, Pb, Sn, Co, Ni, Al, Sb, brass, monel metal, Cu, Bi, Si, Mo, Ag, Ta, Hg, 13% Cr stainless steel, nichrome, 18–8 stainless steel, W, Au, Cr, C, and Pt in solutions of $Fe(NO_3)_3$ (5, 10, 15, 20%) is recorded.   A. J. M.

Electrode potential of metals and alloys in sodium nitrate solution. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 343—355).— The series of electrode potentials of the 21 metals, 2 non-metals, and 6 alloys used in the preceding investigation (see preceding abstract) in $NaNO_3$ solution (5, 10, 15, 20%) is recorded. Mg is the only metal of those investigated which dissolves in $NaNO_3$ solution with evolution of gas.   A. J. M.

Thin metal membranes. R. DEAGLIO (Atti R. Accad. Sci. Torino, Cl. Sci. fis. mat. nat., 1935, **71**, I, 131—135; Chem. Zentr., 1936, ii, 3764).—The e.m.f. of the cell Au|H_2O|Au membrane–Au is not measurable with sputtered membranes which are green by transmitted light, but red membranes give an e.m.f. of 0·6 v. A thermo-electric potential is developed at a junction between a green Au membrane and massive Au, owing to the higher concn. of conductivity electrons in the vol. of the massive metal, and the existence of a non-conducting surface layer on the membrane.   A. J. E. W.

Effect of substituents [in the benzene ring] on the chemical, physico-chemical, and biological properties of chemical compounds. Relationship between chemical constitution and biological action. B. BREYER (Biochem. Z., 1939, **301**, 65—93; cf. A., 1938, II, 118).—Determinations of the effects of substituents (p-NH_2, p-NHMe, p-NMe_2, o-OH, p-NHAc, p-Me, p-NHPh, p-NO_2) in the C_6H_6 ring of HgPh·OAc on solubility in H_2O, extent of decomp. by H_2S, and toxicity to lupin seedlings and the frog heart, and of the same or similar substituents in the C_6H_6 ring of $PhAsO_3H_2$ on dissociation const., reduction potential, ease of decomp. by heat, and toxicity to the mouse, show that the auxochrome theory of Wizinger, which permits approx. prediction of redox potential and of degree of polarity, successfully correlates physical, chemical, and biological properties.   W. McC.

Previous history of the platinum electrode and its influence on the potential jump [induced by] light. E. HOJA (Z. physikal. Chem., 1939, **B, 42**, 432—439).—The light-sensitivity of the system, Pt–aq. ZnO suspension, depends on the presence of (a) traces of hydrated ZnO and (b) a min. amount of an oxide PtO_x which covers the electrode surface. A cathodic polarised Pt electrode gives a positive potential jump, due probably to the oxidation of the H_2 formed on the Pt surface. A Pt electrode warmed in $K_2Cr_2O_7$–H_2SO_4 and an anodic polarised Pt electrode both give a positive potential jump due probably to the decomp. of the PtO_x, with liberation of O_2.   W. R. A.

Theory of passivity and corrosion of metals. P. D. DANKOV (Bull. Acad. Sci. U.S.S.R., 1938, Sér. Chim., 1249—1254).—A review of recent work.   F. H.

Fundamental studies with the dropping mercury electrode. II. Migration of current. J. J. LINGANE and I. M. KOLTHOFF (J. Amer. Chem. Soc., 1939, **61**, 1045—1051; cf. A., 1939, I, 325).— The initial limiting current, i_1, in cation reductions in absence of a foreign electrolyte is ~ twice as large as the diffusion current, i_d, obtained when an excess of an indifferent electrolyte (I) is added to the solution. i_1 decreases most rapidly with the first small additions of (I) and finally attains a const. val. when the concn. of (I) is ~50 times that of the reducible ions. This is illustrated with reference to the effect of various concns. of KCl, KNO_3, and HCl on the i_1 of $PbCl_2$. In anion reductions (e.g., IO_3'), however, i_1, without added (I), is ≪ the i_d obtained in presence of excess of (I). The equations developed by Heyrovský for the relation between i_1 in absence of (I) and i_d in presence of excess of (I) have been modified to include the change in the effective diffusion coeff. of the reducible ions caused by the addition of (I). The exaltation of the migration current i_m of a reducible ion by the preceding discharge of an uncharged substance, e.g., O_2, is decreased by the accumulation of OH' ions at the electrode surface, which decreases the effective transference no. of the reducible ions. The observed exaltation of i_m of K· ions by the preceding discharge of Tl· ions agrees with the calc. val.   W. R. A.

Polarography of iron. S. KAMEGAI (J. Biochem. Japan, 1939, **29**, 285—288).—The height (which is independent of p_H but increases with temp.) of polarographic curves for $FeCl_3$ in PO_4''' buffer–oxalic acid over the range −56 to −195 mv. is ∝ [Fe].   F. O. H.

Electrocrystallisation of zinc on metallic surfaces. D. S. ABRAMSON (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 1197—1210).—The electrodeposition of Zn on Fe, Cu, and Al from aq. $ZnSO_4$ with and without addition of $Al_2(SO_4)_3$, $MgSO_4$, Na_2SO_4, H_3BO_3, gum arabic, maltose, and isoamyl alcohol is studied. During electrolysis of 2·86N-$ZnSO_4$ with a cathode of freshly electrolytically deposited Zn and in the absence of air, there is no increase in overvoltage but with Fe, Cu, or Al cathodes at a c.d. of 4 × 10^{-4} amp. per sq. cm. there is an increase during the initial stages which depends on the c.d., the increase being due to difficulty in forming crystal nuclei. During

deposition of Zn on other metals polarisation occurs, increasing rapidly at low c.d. and becoming const. when c.d. is $>10^{-3}$ amp. per sq. cm. The results of photomicrographic and X-ray examination of the deposits are described and discussed.   F. H.

Calculation of the rate of composite reactions. M. BODENSTEIN (Congr. int. Quim. pura apl., 1934, **9**, II, 256—267; Chem. Zentr., 1936, ii, 3755).— The assumption of stationary concns. of unstable intermediates in the treatment of composite reactions is justified (cf. A., 1913, ii, 1039; Wegscheider, A., 1929, 776). Such methods of treatment are comparable with calculations for simple reactions based on finite concn. and time increments and linear variation of the reactant concns. The intermediate must, however, be consumed by one or more reactions which have a relatively high velocity and, in the case of chain reactions, lead to breaking of the chains.   A. J. E. W.

Limits of inflammability of gases and vapours. H. F. COWARD and G. W. JONES (U.S. Bur. Mines, 1939, Bull. 279, 136 pp.).—Data are given on the limits of inflammability of mixtures of a large no. of combustible vapours or gases with air, O_2, and O_2 diluted with varying proportions of N_2 or CO_2.   F. J. G.

Self-ignition of hydrocarbon–air mixtures under adiabatic compression. W. JOST and H. TEICHMANN (Naturwiss., 1939, **27**, 318—319).— The self-ignition of mixtures of air and n-C_7H_{16}, n-C_8H_{18}, and C_6H_6 under adiabatic compression was studied. The induction period was determined at different temp. The induction period is independent of the initial temp., and the effect of pressure on it is small (cf. Weber et al., A., 1939, I, 268). A. J. M.

Thermal decomposition of fluorine oxide. Theory of unimolecular reactions. H. J. SCHUMACHER (Congr. int. Quim. pura apl., 1934, **9**, II, 485—494; Chem. Zentr., 1936, ii, 3754—3755).— Previous results (A., 1934, 736) are discussed.
A. J. E. W.

Thermal decomposition of diethyl ether. J. G. DAVOUD and C. N. HINSHELWOOD (Proc. Roy. Soc., 1939, **A**, **171**, 39—54).—The decomp. yields a mixture of hydrocarbons and MeCHO and the latter splits to $CH_4 + CO$. Analyses were made of the amount of aldehyde present at each stage of the reaction together with complete analyses of the gaseous products. Older determinations of the reaction rate are corr. to represent more accurately the true initial decomp. Both the normal reaction and that inhibited by the presence of NO were studied.   G. D. P.

Process of polymerisation. J. W. BREITENBACH (Österr. Chem.-Ztg., 1939, **42**, 204—215).— A summary and bibliography of polymerisation reactions classified according to the substances polymerising.   F. J. G.

Kinetics of chain polymerisation. V. Influence of different modes of reaction on the polymolecularity. G. V. SCHULZ. **VI. Distribution of the mol. wt. in the polymerisation of polystyrene.** G. V. SCHULZ and A. DINGLINGER (Z. physikal. Chem., 1939, **B**, **43**, 25—46; 47—57; cf. A., 1938, I, 363).—V. Theoretical. Previous de-

ductions on the distribution of polymerisation products are supplemented by the following mechanisms : uniform coupling, statistical coupling, and polymerisation equilibrium. The influence of each on the distribution of polymerisation products is discussed. VI. The distribution coeffs. of a series of polystyrenes decomposed by fractionation have been determined.   W. R. A.

Thermal decomposition of methylene diacetate, ethylidene diacetate, and paracetaldehyde at low pressures. J. R. DACEY and C. C. COFFIN (J. Chem. Physics, 1939, **7**, 315—317).—The rates of the thermal decomp. of $CH_2(OAc)_2$ (552—590° K.), $CHMe(OAc)_2$ (509—570° K.), and paracetaldehyde (525—566° K.) have been measured down to pressures of 0·05 mm. No fall in the reaction rates is evident. The min. nos. of internal degrees of freedom contributing to the activation energies are 16, 18, and 64, respectively.   W. R. A.

Kinetics of cracking of hydrocarbons under pressure. I. Cracking of normal paraffin hydrocarbons. M. D. TILITSCHEEV (J. Appl. Chem. Russ., 1939, **12**, 105—112).—The velocity coeff. for the reaction of cracking of n-paraffins is expressed by $\log k = \log (n - 6\cdot8) + 14\cdot22 - 13170/T$, where n is the no. of C atoms (>12), and T is abs. temp. (673—873°). The activation energy for $n = 5$—10 is 65,000, and for $n = 11$—32 60,000 g.-cal. per g.-mol.   R. T.

Kinetics and mechanism of cracking of hydrocarbons.—See B., 1939, 570.

Halogen–halide exchange reactions in aqueous solution. R. W. DODSON and R. D. FOWLER (J. Amer. Chem. Soc., 1939, **61**, 1215—1216).—Exchange between $Br^{*\prime}$ and Br_2 and between $I^{*\prime}$ and I_2 occurs completely within 60 sec. The probable mechanism is $Br^{*\prime} + Br_2 = Br^*_3{}' = Br' + Br^*_2$.   W. R. A.

Kinetics of the saponification of the ethyl esters of normal aliphatic acids. H. A. SMITH and H. S. LEVENSON (J. Amer. Chem. Soc., 1939, **61**, 1172—1175).—The kinetics of the saponification of EtOAc, $EtCO_2Et$, and $PrCO_2Et$, determined at 20°, 30°, 40°, and 50°, are compared with the data of Evans et al. (cf. A., 1938, I, 578). Agreement is good for $EtCO_2Et$ and fair for $PrCO_2Et$ (8% difference at 50°). The velocity coeffs. for EtOAc, however, differ by ~25% at 50°. The activation energy of the reactions appears to be const. at ~14,900 g.-cal. per mol. It is concluded that in the equation $k = sZe^{-E/RT}$, E is const. and that changes in k are due to changes in the steric factor, s.   W. R. A.

Kinetic salt and medium effects in the reaction between ethylene chlorohydrin and hydroxyl ion. L. O. WINSTROM and J. C. WARNER (J. Amer. Chem. Soc., 1939, **61**, 1205—1210).—The reaction between $CH_2Cl\cdot CH_2\cdot OH$ (I) and OH′ ion has been investigated at 0°, 15°, 25°, and 35° in H_2O, $EtOH$–H_2O, and in 1 : 4-dioxan–H_2O mixtures of such composition that at each temp. the dielectric const. $D = D_{H_2O}^{35°}$. In absence of CO_2, the reaction in H_2O is strictly bimol. up to 90% completion, and k_2 is independent of the initial concns. of the reactants. In presence of CO_2 however, k_2 drifts to higher vals. as the initial

concn. of reactants is decreased, owing probably to the side reaction of (I) with CO_3'' ions forming $(CH_2 \cdot OH)_2$. The constancy of k_2 over a considerable range of ionic strength both in absence and in presence of neutral salts (KNO_3 and $NaNO_3$) in H_2O and in $EtOH-H_2O$ indicates the absence of appreciable kinetic salt effects. Decrease in D of the solvent increases the reaction velocity as indicated by the theory of Harned and Samaras (cf. A., 1932, 346). The energies of activation, determined in H_2O and in two mixed solvents of const. D, are related according to the predictions of Svirbely and Warner (cf. A., 1935, 1464).   W. R. A.

Mechanism of additions to double bonds. X. Kinetics of association of *cyclo*pentadiene. H. KAUFMANN and A. WASSERMANN (J.C.S., 1939, 870—871; cf. A., 1939, I, 269).—The reaction $2(cyclo$pentadiene) $= endodicyclo$pentadiene has been studied at 25—70° in AcOH, 0—35° in CS_2, and 0—55° in EtOH and in $PhNO_2$. The parameters of the Arrhenius equation are similar for polar and non-polar liquids and the gas phase. Activation energies, coeffs. of velocity, and collision nos. are approx. independent of the medium.   F. R. G.

Internal and external field action of substituents on methyl donors and acceptors. E. HERTEL and H. LÜHRMANN (Z. Elektrochem., 1939, 45, 405—408; cf. A., 1935, 1232; 1936, 12).—The velocity of reaction of p-substituted derivatives of 2 : 6-dinitroanisole with $NMe_2 \cdot C_6H_4 \cdot OMe$ (I) has been studied in $COMe_2$ solution at 35° and 45°. The tendency for the O atom to absorb the electron pair and form an electrovalent link with the Me forming a quaternary salt with (I) increases with variation of the p-substituent in the order NR_2, Me, H, Cl, CN, NO_2. The sp. conductivities of $COMe_2$ solutions of the compounds indicate the same order. The reactivity of o-$C_6H_3Me \cdot NMe_2$ and of $1 : 2 : 6$-$C_6H_3Me_2 \cdot NMe_2$ with MeI is $\ll$ that of $NPhMe_2$. This effect is attributed to internal field action. The basicity of $NPhMe_2$ is almost unaltered by the introduction of two Me in the o-position, but is greatly diminished by the introduction of Br in the m-position. The relative effects of o-, m-, and p-substituents are discussed.   J. W. S.

Treatment of observations on a unimolecular reaction by the theory of errors. J. MOLLAND (Arh. norsk. Vidensk.-Akad. Oslo, I, 1936, No. 2, 15 pp.; Chem. Zentr., 1936, ii, 4084—4085).—Errors in the polarimetric study of the hydrolysis of d-$\alpha\alpha'$-dimethylsuccinic anhydride at 20° are evaluated and discussed. Two series of measurements gave $k = 0.0662$ and 0.0664 ± 0.00016. No catalytic effect of $H^\cdot$ is observed, k remaining const. during the hydrolysis.   A. J. E. W.

Thermal decomposition of the ammonium chromates. K. FISCHBECK and H. SPINGLER (Z. anorg. Chem., 1939, 241, 209—224; cf. A., 1938, I, 209).—The kinetics of the decomp. of $(NH_4)_2CrO_4$ (I), $(NH_4)_2Cr_2O_7$ (II), and $(NH_4)_2Cr_3O_{10}$ (III), at 160—240°, have been studied. The reaction–time curves are of the S-shaped autocatalytic type, and since there is no equilibrium between reactants and resultants there can be no question of the crystallisation of a

supersaturated phase, but there must be direct catalysis by the products. During the induction period, before the evolution of N_2 has become measurable, appreciable quantities of NH_3 are given off from (I), and this process is partly reversible. The formation of a nucleus apparently involves liberation of H_2CrO_4 or CrO_3 on the surface. For all three salts, the % decomp. in the early stages $\propto t^4$, as is to be expected if the no. of nuclei formed in a given time is const. Throughout the rest of the reaction time for (II) and (III), and in the later stages for (I), a formula of the " contracting sphere " type holds. The departures from this in the case of (I) are due to reversible loss of NH_3. The duration of the induction period is independent of temp. for (I); for (II) and (III) it decreases rapidly with increasing temp. During the main period of the reaction the Arrhenius equation holds, with $E = 40,000$, $49,000$, and $34,000$ g.-cal. for (I), (II), and (III), respectively.   F. J. G.

Theory of cation exchange of permutites. I—III. N. L. RADIMOV (J. Gen. Chem. Russ., 1939, 9, 3—11, 12—19, 20—25).—I. Exchange of cations between glauconites and solutions takes place in accordance with the law of mass action, within certain concn. limits. Glauconites saturated with Ca may be regenerated with sea-H_2O.

II. The velocity of exchange of cations is limited by the velocity of diffusion of ions in the adsorption layer. An expression for the kinetic activity of permutites is derived.

III. The heat of exchange of cations (Ca, Mg, Na) from permutites has been determined. The results are in agreement with theoretical considerations.   R. T.

Spontaneous inflammation of sodium hyposulphite.—See B., 1939, 600.

Kinetics of the decomposition of *n*-butane. II. Inhibition by nitric oxide and propylene. L. S. ECHOLS and R. N. PEASE (J. Amer. Chem. Soc., 1939, 61, 1024—1027; cf. A., 1939, I, 149).—Inhibition of the decomp. of n-C_4H_{10} by NO and by C_3H_6 attains a limit as the concn. of inhibitor increases and it diminishes as the reaction proceeds, owing probably to reversible formation of an intermediate product. The data are compared with those of the normal decomp. and possible mechanisms are suggested.   W. R. A.

Prediction of rate constants from equilibrium data for reactions in D_2O-H_2O mixtures. F. BRESCIA (J. Chem. Physics, 1939, 7, 310—313).—The reaction rates for sp. $H^\cdot$- and sp. OH'-catalysed reactions, in H_2O-D_2O mixtures, can be predicted from equilibrium data on the assumption that the rate $\propto$ the fraction of $D^\cdot$ and the fraction of OD', respectively. Agreement between the predicted and observed rates is good for sp. $H^\cdot$-catalysed reactions (hydrolysis of acetal, MeOAc, and HCO_2Et). The lack of agreement in the sucrose, glucose, and diacetone alcohol reactions may be due to substrate exchange with solvent.   W. R. A.

Kinetics of the catalysed esterification of methyl- and phenyl-substituted aliphatic acids in methyl alcohol. H. A. SMITH (J. Amer. Chem. Soc., 1939, 61, 1176—1180).—The kinetics of the $H^\cdot$-

catalysed esterifications of $Pr^\beta CO_2H$, $Bu^\beta CO_2H$, $CHMeEt·CO_2H$, 4-methylvaleric, phenylacetic (I), hydrocinnamic (II), and γ-phenylbutyric (III) acids have been measured at 20°, 30°, 40°, and 50° in MeOH. Data indicate that the reaction velocity is affected only by substitution of Me in the α- or β-position. The increase in the total no. of C in a straight chain up to 4 has a considerable effect on the reaction velocity even when the position of substitution remains unchanged. The velocity coeffs. for (I), (II), and (III) are the same and $\simeq$ the val. for $Pr^\beta CO_2H$. This is discussed in the light of the postulated ring structure of the aliphatic acids.   W. R. A.

Relation between the velocity of inversion of sucrose and the hydrogen-ion activity in concentrated solutions of hydrochloric acid, pure or mixed with a chloride. M. DUBOUX and J. ROCHAT (Helv. Chim. Acta, 1939, 22, 563—579).—From the vals. of the mean activity coeff. of HCl (γ_{HCl}) (A., 1928, 567) and assuming that $\gamma_{Cl} = \gamma_K$ for all concns. of KCl and that γ_{Cl} is dependent only on the [Cl'] (MacInnes, A., 1919, ii, 385) the vals. of γ_H are deduced for conc. solutions of HCl, with and without the addition of sucrose, NaCl, NH_4Cl, or $MgCl_2$. In aq. HCl alone, γ_H decreases with increasing concn. (m), passing through a min. at $m = 0.18$M., and then increases. γ_H is increased considerably by the addition of chloride. Addition of sucrose also increases γ_H, especially at lower m. The velocity of inversion of sucrose in conc. aq. HCl is approx. $\propto a_H.a_{H_2O}$ (a = activity).   J. W. S.

Polymerisation of vinyl acetate. A. C. CUTHBERTSON, G. GEE, and E. K. RIDEAL (Proc. Roy. Soc., 1939, A, 170, 300—322).—The course of polymerisation was followed by dilatometric measurements. Pure vinyl acetate at 60°, 80°, and 100° and in PhMe solutions at 80° was investigated with varying concns. of Bz_2O_2 as catalyst. An induction period is observed and the results are consistent with the view that a complex formed from catalyst and monomeride breaks down to give a reaction centre. The catalyst is decomposed during the reaction. Chain lengths of the polymeride are computed from viscosity data and the energy of activation for the decomp. of catalyst and for the process of polymerisation are calc.   G. D. P.

Exchange of chlorine substituted in aromatic nuclei for amino-group.—See A., 1939, II, 255.

Exchange reaction between ethylene and deuterium on a nickel catalyst. G. H. TWIGG and E. K. RIDEAL (Proc. Roy. Soc., 1939, A, 171, 55—69).—The exchange and hydrogenation reactions between C_2H_4 and D_2 on a Ni catalyst in the temp. range 60—207° were investigated by determining the D_2 content of the H_2–D_2 mixtures formed in the reaction. The exchange process takes place through the primary addition of a D atom to a chemisorbed C_2H_4 mol. forming an Et radical which then decomposes to a deuterated ethylene mol. and releases a H atom. On this basis predictions are made as to double bond migration and exchange reactions in higher olefines. It is suggested that in hydrogenation the H_2 mol. adds as a whole to the C_2H_4 and not as atoms. The energy of activation of exchange is const. up to 100° but

diminishes at higher temp. as a result of the desorption of H held above the chemisorbed C_2H_4 layer.   G. D. P.

Infra-red analysis applied to the exchange reaction between ethylene and deuteroethylene. G. K. T. CONN and G. H. TWIGG (Proc. Roy. Soc., 1939, A, 171, 70—78).—The absorption spectrum of a C_2H_4–C_2D_4 mixture was recorded in the range 6.9 to 9.3 μ. before and after heating on the catalyst. No change was observed on heating, whence it is concluded that no exchange takes place when the two ethylenes are heated, and that dissociation does not take place to any great extent. The results confirm the view as to the nature of the mechanism of exchange between C_2H_4 and D_2 arrived at above (cf. preceding abstract).   G. D. P.

Compressed catalysts. P. IVANNIKOV (J. Gen. Chem. Russ., 1939, 9, 176—177).—The yield of EtOAc obtained from EtOH with CuO–Al_2O_3–UO_3 catalyst at 200—350° is much higher when the catalyst is compressed (20,000 kg. per sq. cm.). The yield of AcOH falls correspondingly.   R. T.

Mechanism of contact hydrogenation of carbonyl groups in presence of metallic catalysts. J. HORIUTI and T. KWAN (Proc. Imp. Acad. Tokyo, 1939, 15, 105—109).—When EtOH containing 33% of EtOD is shaken with Pt-black (I) in H_2, no D is found in the Et. The rate of hydrogenation of $COMe_2$ in presence of (I) is nearly $\propto p$ for 200—500 mm., is doubled by N-HCl, and is 0.25 times as great in presence of N-NEt$_3$. With Ni catalyst, HCl and NEt$_3$ do not affect the rate. H_2 at 20—200 mm. with MeCHO containing 10% of MeCDO takes up 1% of D with Ni but <0.2% with (I). No interchange of D with H occurs with $COMe_2$ containing 7% of $COMe·CH_2D$ similarly hydrogenated with H_2 whilst when $COMe_2$ is hydrogenated with H_2 containing 2.33% of D_2, the latter decreases at approx. the same rate as p. It is concluded that the reaction follows the course $:C·O + H_2 \rightarrow :C·O + H_2^+ \rightarrow :C·O + H^+ + H \rightarrow :C·OH^+ + H \rightarrow :CH·OH$ and is governed by the last step.   F. R. G.

Catalytic decomposition of oxalic acid by colloidal platinum carbonyl. I. SANO (Bull. Chem. Soc. Japan, 1939, 14, 121—131).—0.10, 0.05, and 0.025N-$H_2C_2O_4$ solutions have been oxidised in O_2 in diffused daylight using red Pt carbonyl sols and black Pt sols. Experiments extended for several hundred hr. at 25° and for 30 hr. at 50°. With the red sols the reaction is unimol. after induction and transition periods whilst black sols give a unimol. rate without an induction period. The sols are more stable in dil. acid and hence the velocity coeff. is greater.   T. H. G.

Stationary state of catalysts in heterogeneous reactions. II. C. WAGNER and K. HAUFFE (Z. Elektrochem., 1939, 45, 409—425; cf. A., 1938, I, 258).—The velocity of dissociation of H_2 on Pd surfaces has been determined by measurement of the velocity of absorption and evolution of H_2 and the velocity of reaction between H_2 and D_2. The change of para-H_2 on a Pd surface is >10 times as rapid as would be anticipated from the rate of absorption of

H_2. It is inferred that the change occurs not only through the dissociation of H_2 mols. but also to a considerable extent through rearrangement of the nuclear spin moment under the influence of the paramagnetic Pd, or by exchange with adsorbed H atoms. In the union of H_2 and O_2 on Pd at 160° the stationary concn. of H atoms corresponds with the equilibrium with H_2 mols., and hence it is concluded that reaction occurs through H_2 mols. or by a chain mechanism. During combination of C_2H_4 and H_2 on Pd, however, the at. H concn. is < that present at equilibrium with H_2. The reaction appears to occur partly through H atoms and partly either through H_2 mols. or by a chain mechanism.　　　J. W. S.

Causes of loss of platinum in oxidation of ammonia with a platinum catalyst.—See B., 1939, 599.

Catalytic phenylation of α-naphthylamine and of α-naphthylamine-8- and -5-sulphonic acids. —See B., 1939, 576.

Secondary hydrogen evolution at the cathode. D. REICHINSTEIN (Helv. Chim. Acta, 1939, **22**, 554—563).—Theoretical. The author's displacement theory is applied to the development of equations for galvanic polarisation, which predict that the polarisation potential during steady-state electrolysis should vary linearly with the amount of H_2 absorbed by the faces of the electrode. This is in accord with Masing and Laue's observations on secondary H_2 evolution from Pt cathodes (A., 1937, I, 85).　　　J. W. S.

Formation of anode precipitates. A. GLAZUNOV (Chem. Listy, 1939, **33**, 183—186).—Parallels are drawn between the formation of anode ppts. and the cathodic deposition of complexes, e.g., Ag_2I. Conditions promoting pptn. are high c.d. and slow solubility in the electrolyte of the complex formed. Metastable ppts. are commonly formed when the complex anion forms a solid solution with its decomp. products; stable ppts. are usually formed only when the element deposited can exhibit higher valency.　　　A. R. W.

Cathodic evolution of arsenic in electrolytes containing zinc. L. CAMBI and G. G. MONSELISE (Rend. 1st. Lomb. Sci. Lett., 1936, [ii], **69**, 392—396; Chem. Zentr., 1936, ii, 3643).—Cathodic reduction of As in acid aq. $ZnSO_4$ is inhibited by $Mg^{..}$ or $Al^{...}$ and C_5H_5N, owing to formation of a cathode film composed of C_5H_5N and basic salts. C_5H_5N, $Mg^{..}$, $Al^{...}$, $Mn^{..}$, and $Mn^{..} + C_5H_5N$ have little or no effect when present separately.　　　A. J. E. W.

Electrolytic preparation of carbon-free chromium from solutions of tervalent chromium salts. —See B., 1939, 619.

Electrolytic cobalt plating, using insoluble anodes.—See B., 1939, 619.

Electrolytic reduction of nitrobenzene in liquid ammonia.—See A., 1939, II, 306.

Cathodic reduction of aromatic nitroso-compounds below the hydrogen deposition potential. E. HERTEL and A. LENZ (Z. Elektrochem., **45**, 395—401).—PhNO, p-NO·C_6H_4·OH, and p-NO·C_6H_4·NMe_2 can be reduced electrolytically in dil.

H_2SO_4 solution at high c.d. below the H deposition potential. The effects of velocity of stirring, temp., concn. of NO-compound, nature of the p-substituent, nature of the electrode metal, and the nature of the medium on the form of the voltage–current curve have been investigated. An equation developed for the current is in accord with experiment. The heat of activation of the reactions appears to be small, and the effect of temp. is mainly attributable to change in the velocity of diffusion.　　　J. W. S.

Electrodeposition of nickel from nickel chloride solutions.—See B., 1939, 619.

Chemical action of high-frequency corona discharge on ethyl alcohol vapour. J. T. EIDUS (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 1167—1173).—At low pressure or with A at 1 atm. dehydrogenation is the primary reaction caused by high-frequency corona discharge on EtOH vapour. MeCHO formed is then decomposed to CO and CH_4.　　　F. H.

Inertia and chemical activity of the rare gases. Action of helium on sodium under the influence of electrical discharge at low pressures. H. DAMIANOVITCH (Anal. Assoc. Quím. Argentina, 1938, **26**, 249—253).—A discharge of 350 v. and 5 ma. from a Na cathode in He at 2—4 mm. gives a grey deposit on the walls of the tube accompanied by decrease in pressure and rise in temp. Formation of HeNa is presumed.　　　F. R. G.

Photochemical decomposition of ammonia. S. SHIDA (Rev. Phys. Chem. Japan, 1939, **13**, 12—30).—The reaction has been studied both by direct determination of non-condensible products and by analysis of the thermal expansion produced on irradiation. The reaction is largely heterogeneous. Contrary to the findings of Wiig (A., 1937, I, 370), the quantum yield increases with decreasing pressure of NH_3 even below 100 mm. The addition of N_2 causes a slight increase in the quantum yield.　　　F. J. G.

Hydrogen–chlorine reaction. I. Significance of the course of the reaction with oxygen-free gases. M. BODENSTEIN and E. WINTER (Sitzungsber. preuss. Akad. Wiss. Berlin, Phys.-math. Kl., 1936, 2—18; Chem. Zentr., 1936, ii, 1672—1673).— Substitution of a glass reaction vessel by a Ag vessel with a glass window protected by a H_2 stream causes a substantial increase in the quantum yield (γ) of the photochemical reaction. This confirms that chains are broken in the gas phase by reaction of Cl atoms with a Si chloride produced from the glass (cf. A., 1931, 319). Collisions of Cl atoms with the walls occur $\sim 10^4$ times more frequently than chain breakages, so that diffusion effects are negligible and fixation of Cl atoms on the walls is $\propto$ their concn. in the gas phase. The accommodation coeff. is reproducible and corresponds with a γ val. of $\sim 4.2 \times 10^6$ mols. per quantum, the chains having a mean life of 16 sec. The inhibiting effect of HCl observed by Ritchie and Norrish (A., 1933, 576) is ascribed to a wall effect.　　　A. J. E. W.

Influence of pressure on photographic sensitivity to X-rays. S. S. LU, C. HUNG-CHI, and L.

TA-YUAN (Compt. rend., 1939, **208**, 1296—1297).— A rise in pressure (110—1080 kg. per sq. cm.) may increase or decrease the sensitivity, according to the particular film in use. In either case the ratio of the image densities with and without applied pressure is independent of the exposure. It is suggested that two opposing pressure effects exist, which are comparable in the X-ray region but severally predominate in the γ-ray and the visible and ultra-violet regions. Application of pressure before exposure causes a corresponding but less pronounced effect, but pressure after exposure causes an increase of sensitivity in every case studied.   A. J. E. W.

Photo-oxidation of di*iso*propyl ether. G. RADULESCO (Ann. Off. nat. Combust. liq., 1938, **13**, 1071—1082).—Under the light from a 500-w. lamp Pr^β_2O yields $COMe_2$, H_2O, peroxides, and resinous products. The photo-oxidation was retarded by 0.1% of p-cresol, p-$NH_2 \cdot C_6H_4 \cdot OH$, or p-$C_6H_4(NH_2)_2$, but accelerated by 0.1% of α-$C_{10}H_7 \cdot OH$.   R. B. C.

Chemical reactions produced by α-particles. W. MUND (Congr. int. Quim. pura apl., 1934, **9**, II, 304—322; Chem. Zentr., 1936, ii, 3756; cf. A., 1934, 497).—A review.   A. J. E. W.

Polymerisation of liquids by irradiation with neutrons and other rays. F. L. HOPWOOD and J. T. PHILLIPS (Nature, 1939, **143**, 640).—Curves showing the contraction in vol. produced in Me methylacrylate by exposure to neutrons and to γ-rays are reproduced. Styrene, vinyl acetate, and a ketone behave similarly.   L. S. T.

Action of water on sodium, copper, and mercury. G. COSTEANU and P. RENAUD (Compt. rend., 1939, **208**, 1014—1016).—A jet of H_2O vapour impinging on a Na surface in a vac. reacts rapidly when a high p.d. is established between the jet and the surface, although no action occurs in the absence of a p.d. (cf. A., 1938, I, 206). Cu and Hg surfaces are also blackened, and with Hg production of O_3 and H_2O_2 has been detected. The effect of the p.d. is to increase the no. of high-energy collisions.
                                                A. J. E. W.

Sodium polyphosphates. II. K. R. ANDRESS and K. WÜST (Z. anorg. Chem., 1939, **241**, 196—204; cf. A., 1938, I, 319).—The products obtained when equimol. mixtures of $NaPO_3$ and $Na_4P_2O_7$ are heated at $>600°$ have been studied by determining their binding power for Ca. From $600°$ to $660°$ there is increasing dissociation of $Na_5P_3O_{10}$ into $NaPO_3 + Na_4P_2O_7$, but with further rise of temp. a new equilibrium is set up, the product having increased hygroscopicity and Ca-binding power. This product, on tempering at $600°$, is very rapidly transformed into $Na_5P_3O_{10}$.   F. J. G.

[Sulphides, selenides, and tellurides of] the alkali metals. W. KLEMM, H. SODOMANN, and P. LANGMESSER (Z. anorg. Chem., 1939, **241**, 281—304). —Experimental details for the prep. of alkali sulphides, selenides, and tellurides are given. Direct synthesis in liquid NH_3 is applicable in most cases, but the Cs compounds are best prepared from Cs and HgS, HgSe, or HgTe. Vals. for ρ_4^{25} are recorded as follows : Rb_2Se, 3.575; Rb_2Te, 3.620; Cs_2S, 4.150; Cs_2Se

4.395; Cs_2Te, 4.300. The inter-ionic distances and mol. vols. for the mono-compounds are discussed. The increments for Se″ and Te″ are 34 and 46 c.c., respectively, and those for K˙, Rb˙, and Cs˙, when associated with bivalent anions, are 15, 18, and 22 c.c., $i.e.$, rather $<$ the usual vals. The system K–Se has been investigated by means of cooling-curves and X-ray analysis, the existence of K_2Se, K_2Se_2, K_2Se_3, K_2Se_4, and K_2Se_5 being definitely indicated, whilst K_2Se_6 may exist. K_2Se and K_2Te form solid solutions with excess of Se or Te up to the approx. compositions $K_2Se_{1.2}$ and $K_2Te_{1.3}$, but the Na compounds show little, if any, mixed crystal formation. Vals. of χ at room temp. and at $-183°$ are given for all known sulphides, selenides, and tellurides of Na, K, Rb, and Cs. They are all diamagnetic; the tetra-compounds are therefore true poly-compounds, to be formulated K_2S_4 etc., and are not analogous to the dioxides. The vals. for the mono-compounds agree with those calc. by Angus (A., 1932, 795). The vals. for the poly-compounds are not in general compounded additively of those for the mono-compounds and for the free element. The idea (A., 1936, 148) that K_2S_3 becomes ferromagnetic at low temp. is unfounded; it is diamagnetic even at $-183°$, and the phenomenon which suggested ferromagnetism is a strong pyro-electric effect, also exhibited by K_2Se_3, K_2Se_4, Rb_2S_3, Rb_2Se_3, Rb_2Se_4, and Cs_2Se_3.   F. J. G.

Preparation of potassium ferrocyanide from calcium cyanamide. S. A. VIGDOROV (J. Appl. Chem. Russ., 1939, **12**, 46—49).—Of a no. of methods, that of Wöhler (A., 1934, 1341) is preferred. R. T.

Specific effects of certain tissue extracts on the crystallisation pattern of cupric chloride. D. L. MORRIS and C. T. MORRIS (J. Physical Chem., 1939, **43**, 623—629).—Inorg. salts, simple sugars, and glycine have a negligible influence on the crystallisation of $CuCl_2$. Solutions of starch and glycogen and extracts of cereal grains produce patterns which are characteristic of the substance added. Proteins and autolysed cereal extracts give non-characteristic patterns. An active fraction which gives the characteristic pattern has been isolated from oats. It contains 80% of polysaccharide and a S compound, and appears to be free from starch. Photomicrographs are given.   C. R. H.

Metallic amides and metallic nitrides. VII. Copper nitride. R. JUZA and H. HAHN (Z. anorg. Chem., 1939, **241**, 172—178; cf. A., 1938, I, 562).— Pure Cu_3N may be obtained by heating freshly dehydrated CuF_2 in NH_3 at $280°$. Complete decomp. occurs in vac. at $450°$. In N_2 decomp. begins at $300°$, and in NH_3 at $330°$. Cu_3N reacts with H_2 at $230°$, and in O_2 it is superficially oxidised at $300°$ and burns at $400°$. Its heat of formation is -17.8 kg.-cal. per g.-mol., and $\rho_4^{25} = 5.84$. χ for various preps. ranges from 0.05 to 0.5×10^{-6}, probably because of the presence of traces of Fe or Ni.   F. J. G.

Preparation of anhydrous beryllium chloride from beryllium oxide through beryllium carbide. J. KIELLAND and L. TRONSTAD (Kong. Norske Vidensk. Selsk. Forh., 1936, **8**, 147—150; Chem. Zentr., 1936, ii, 3644—3645).—Be_2C is pre-

pared by heating BeO with sugar C at $\Rightarrow 2100°$; decomp. is rapid at 2230°. Chlorination of Be_2C at $\not< 300°$ yields $BeCl_2$, which should be separable from $AlCl_3$ and $FeCl_3$ by fractional distillation.
                           A. J. E. W.

Fluoberyllates and their analogy to sulphates. VI. Fluoberyllates of metalammino-complexes. N. RÂY (Z. anorg. Chem., 1939, 241, 165—171).—The following *ammino-fluoberyllates* are described: $[Ag(NH_3)_2]_2BeF_4,2H_2O$; $[Ag(NH_3)_2]_2BeF_4$; $[Cu(NH_3)_4]BeF_4,H_2O$; $[Cu(NH_3)_2]BeF_4$; $[Zn(NH_3)_4]BeF_4$; $[Cd(NH_3)_4]BeF_4$; $[Ni(NH_3)_6]BeF_4$; $[Ni(NH_3)_4]BeF_4,2H_2O$; $[Ni(NH_3)_2]BeF_4$; $[Ni(NH_3)_6]BeF_4,2KI$; $[Co(NH_3)_6]_2(BeF_4)_3,3H_2O$; $[Co(NH_3)_6](BeF_4)Cl$.   F. J. G.

Preparation of anhydrous magnesium chloride. W. D. TREADWELL, A. COHEN, and T. ZÜRRER (Helv. Chim. Acta, 1939, 22, 449—456).—Anhyd. $MgCl_2$ can be prepared from MgO by passing a mixture of CO and Cl_2 over the MgO heated at 740—750° in a vertical tube so arranged that the $MgCl_2$ formed can drip into a receiver. If 210 c.c. of CO and 200 c.c. of Cl_2 per min. are passed over 400—500 g. of MgO under these conditions practically no Cl_2 or CO passes into the atm. with the waste gas. An apparatus suitable for the prep. is described.   J. W. S.

Structure of magnesium silicates. E. THILO (Forschung. u. Fortschritte, 1939, 15, 170—171).— The structure of talc $[Mg_6Si_8O_{20}(OH)_4]$, anthophyllite $[Mg_7Si_8O_{22}(OH)_2]$, and enstatite $(Mg_8Si_8O_{24})$ has been investigated. The difference between these representatives of different classes of silicates is chiefly in the structure of the anion. In talc there is a plane of OH^- and a plane of $[Si_8O_{20}^{8-}]$, each Si being surrounded by 4 O. The anion of anthophyllite also consists of SiO_4 units, the ion being $[Si_8O_{22}^{12-}]_n$. In enstatite, chains of simple SiO_4 tetrahedra are found. When talc is heated to temp. $> 900°$ it gives mesoenstatite, $MgSiO_3$, not identical with enstatite. The talc first goes through a completely disordered or amorphous stage, from which two forms of $MgSiO_3$ (known as M_1 and M_2) are formed at higher temp., these being finally converted into mesoenstatite. Anthophyllite, on the other hand, passes directly into enstatite when heated. This difference is explained on the basis of the structure of the anions. The three principal forms of $MgSiO_3$, enstatite, mesoenstatite, and klinoenstatite, are readily converted one into the other. Enstatite is produced from all forms by heating at 900°, mesoenstatite at 900—1270°, and klinoenstatite is stable only at temp. $> 1270°$. M_1 and M_2 forms are possibly metastable, and have been obtained only from talc or amorphous synthetic $MgSiO_3$.   A. J. M.

Chemical composition and crystalline structure of the product of slow oxidation of magnesium in presence of moisture. R. FAIVRE and A. MICHEL (Compt. rend., 1939, 208, 1008—1010).— The black oxidation product (cf. Chaudron and Michel, Bull. Soc. chim., 1938, [v], 5, 1609), freed from unchanged Mg by treatment with EtBr (in Et_2O), possesses a brucite structure and consists of $Mg(OH)_2$ containing ~ 6 additional Mg atoms per 100 $Mg(OH)_2$ mols. The cryst. parameter a of the black product

(3·142 A.) is $>$ that of brucite (3·135 A.), showing that the Mg atoms are inserted in the brucite lattice, probably between the electrically neutral layers parallel to the {001} plane.   A. J. E. W.

Physico-chemical analysis, in connexion with sulphuric acid treatment of phosphates. Transformations of calcium sulphate crystal hydrates in presence of phosphoric acid at 80°. A. P. BELOPOLSKI, A. A. TAPEROVA, and M. N. SCHULGINA (J. Appl. Chem. Russ., 1939, 12, 3—13).—At 80° the stability of different forms of $CaSO_4$ rises in the order $CaSO_4,0·5H_2O <$ gypsum $<$ anhydrite, in presence of $\Rightarrow 30\%$ P_2O_5; with $> 35\%$ P_2O_5 the order is gypsum $< CaSO_4,0·5H_2O <$ anhydrite. The changes are not continuous, a certain time elapsing between formation of a metastable form and its conversion into the stable one; this is ascribed to supersaturation of the solution with the new phase, with delayed crystallisation.   R. T.

Calcium arsenates. System calcium oxidearsenic pentoxide–water at 17°. H. GUÉRIN (Compt. rend., 1939, 208, 1016—1018; cf. A., 1938, I, 359).—The stable *compounds* $CaH_4(AsO_4)_2$, $Ca_2H_2(AsO_4)_2,2H_2O$, $Ca_2H_2(AsO_4)_2,4H_2O$, $5CaO,2As_2O_5,10H_2O$, $Ca_3(AsO_4)_2,xH_2O$, and $4CaO,As_2O_5,5H_2O$, and the unstable *hydrate* $Ca_2H_2(AsO_4)_2,6H_2O$ have been characterised. The conditions of formation and the p_H and concn. limits for which these compounds are stable are studied.
                       A. J. E. W.

Compounds of zinc salts with quinoline. T. L. CHANG (Z. anorg. Chem., 1939, 241, 205—208).— The following *Zn quinolino-salts* are described: $Zn(NO_3)_2,2C_9H_7N$, m.p. 185°; $2ZnSO_4,C_9H_7N$; $2(HCO_2)_2Zn,C_9H_7N$, m.p. 130°; $(EtCO_2)_2Zn,C_9H_7N$, m.p. 145°; $Zn(OBz)_2,C_9H_7N$, m.p. 185°; $2(Pr^aCO_2)_2Zn,C_9H_7N$, m.p. 153°; $2(Bu^aCO_2)_2Zn,C_9H_7N$, m.p. 148°; $2(C_5H_{11}{}^a\cdot CO_2)_2Zn,C_9H_7N$, m.p. 145°. All m.p. are with decomp.   F. J. G.

Reactions in the solid state at high temperatures. XXIII. Theory of the active structures which arise at the beginning of a reaction in the solid state. W. JANDER [with H. HERRMANN] (Z. anorg. Chem., 1939, 241, 225—232).—The author's views (cf. A., 1933, 1128) and those of Hüttig are compared. The only important difference is that the author's " reaction zone " is regarded as being only a few mols. thick, whereas Hüttig's " inner diffusion " refers to deep penetration of the lattice of the one solid by mols. of the other, with the production of a completely disordered structure. This latter view is supported chiefly by X-ray diagrams obtained by Hüttig *et al.* (A., 1938, I, 410) for $ZnO–Fe_2O_3$ mixtures after heating at various temp. These experiments have been repeated, and no indication of the presence of large amounts of amorphous material was found at any stage. On the other hand specimens heated at 500° and at 650° showed faint lines which could not be assigned to either the reactants or the product, and possibly indicate the temporary existence, in the reaction zone, of some metastable structure or compound.   F. J. G.

Mercury halogenosulphides and halogeno-selenides. A. BARONI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 76—79).—Electron diffraction measurements and chemical analyses confirm the formation by the action of H_2S or H_2Se on dil. aq. or MeOH solutions of Hg halides of the following compounds : $HgS,HgCl_2$, $2HgS,HgCl_2$, $HgSe,HgCl_2$, $2HgSe,HgCl_2$, and the corresponding Br and I compounds.   O. J. W.

Reactions between solids. F. TARADOIRE (Bull. Soc. chim., 1939, [v], **6**, 866—872).—Reaction has been observed in many cases when solid materials are placed in contact at $<30°$ in the presence of atm. H_2O. After drying the solids over P_2O_5, however, no reaction occurs, but if H_2O vapour is introduced reaction takes place, sometimes very rapidly. Exceptions are found in the cases of the systems $HgCl_2$–KI, $HgCl_2$–Cu, and SeO_2–$Na_2S_2O_3$, in which reaction appears to continue in the absence of H_2O. In each of these cases there is one reactant which is appreciably volatile at room temp. No reaction occurs between NH_4Cl and CaO or PbO when kept at room temp. in the absence of H_2O vapour, but a brisk reaction occurs as soon as the mixture is introduced into moist air. In the examples studied the reactants are too far from their m.p. for diffusion of the solids to play any part in the reaction.
                                                J. W. S.

Preparation of pure alumina from aluminium sulphate.—See B., 1939, 600.

Sesquioxide and hydroxides of gallium. A. W. LAUBENGAYER and H. R. ENGLE (J. Amer. Chem. Soc., 1939, **61**, 1210—1214).—The system Ga_2O_3–H_2O has been studied by fusion-quenching, hydrothermal-quenching, and dehydration methods and phases have been identified by X-ray diffraction, and by microscopical and chemical examination. The compounds isolated were $α$-Ga_2O_3, $β$-Ga_2O_3, GaO(OH), and $Ga(OH)_3$, and their properties and ranges of stability are discussed. A mechanism of pptn. of Ga and ageing of the gelatinous ppt. is suggested. $Ga(OH)_3$ is a fine powder, sol. in dil. mineral acids, but practically insol. in H_2O; it has a distinctive X-ray diffraction pattern.   W. R. A.

Bi- and quadri-valent compounds of the rare earths. VII. Structure of some dihalides. W. DÖLL and W. KLEMM (Z. anorg. Chem., 1939, **241**, 239—258).—$CaBr_2$ has the $CaCl_2$ structure (C 35) with a 6·55, b 6·88, c 4·34 A. YbI_2 has the " CdI_2 " structure (C 6) with a 4·48, c 6·96 A. The following have the $PbCl_2$ structure (C 23) : $BaCl_2$, with a 4·70, b 7·82, c 9·33 A.; $BaBr_2$, with a 4·95, b 8·25, c 9·84 A.; BaI_2, with a 5·27, b 8·86, c 10·57 A.; $SmCl_2$, with a 4·50, b 7·53, c 8·97 A.; $EuCl_2$, with a 4·49, b 7·50, c 8·91 A. The structures of the following could not be determined : $YbCl_2$, $SrBr_2$, $SmBr_2$, $EuBr_2$, $YbBr_2$, SrI_2, SmI_2, and EuI_2; they are not of the TiO_2, $CaCl_2$, CaF_2, $CdCl_2$, CdI_2, or $PbCl_2$ types. Those of $SrBr_2$, $SmBr_2$, and $EuBr_2$ are similar, and differ from that of $YbBr_2$, whilst those of SmI_2 and EuI_2 are similar and have some resemblance to that of SrI_2. The occurrence of the $PbCl_2$ type among the alkaline-earth halides is analogous to that of the CsCl type among the alkali halides, and requires a cation having a relatively high polarisability. SmI_2, $YbBr_2$, and YbI_2 have $ρ_4^{25}$ 5·469, 5·906, and 5·702, respectively.
                                                F. J. G.

Bi- and quadri-valent compounds of the rare earths. VI. Halides of bivalent europium. W. KLEMM and W. DÖLL. **VIII. [Sulphide, selenide, and telluride of] bivalent europium.** W. KLEMM and H. SENFF (Z. anorg. Chem., 1939, **241**, 233—238, 259—263).—VI. Vals. of $χ$ at various temp. are recorded for EuF_2, $EuCl_2$, $EuBr_2$, and EuI_2. The corresponding mol. moments are 7·4 and 7·9 Bohr magnetons for EuF_2 and for the other halides, respectively, the latter val. being that expected from theory, and the discrepancy with EuF_2 being attributed to contamination with EuF_3. $ρ_4^{25} = 5·44$ for $EuBr_2$ and 5·50 for EuI_2. $EuCl_2,8NH_3$ is described.
VIII. Eu^{II} *selenide* and *telluride* have been obtained by heating $EuCl_2$ with excess of Se or Te in a stream of H_2. EuS (cf. A., 1938, 1, 530) may be prepared in the same way. Vals. of $χ$ at various temp. are recorded for all three, and give mol. moments of 7·4 to 7·9 magnetons, in agreement with theory for ionic binding. They have the NaCl structure, with $a =$ 5·956, 6·173, and 6·572 A. for EuS, EuSe, and EuTe, respectively. The radius of the Eu˙˙ ion is $<$ that of the Sr˙˙ ion by $\sim$0·03 A.   F. J. G.

Concentration of carbon (^{13}C) by diffusion. M. DE HEMPTINNE and P. CAPRON (J. Phys. Radium, 1939, [vii], **10**, 171—175).—Using a battery of 51 Hg-vapour diffusion pumps the ^{13}C concn. of CH_4 has been increased to 50% as indicated by examination of the Swan bands of C. Operational details and optimum conditions are discussed.   W. R. A.

Stability of stannous oxide. E. CREPAZ (Atti R. Ist. Veneto Sci., Lett. Arti, 1936, **95**, II, 445—450; Chem. Zentr., 1936, ii, 3994).—Decomp. of SnO (prepared from $SnCl_2$ by pptn. with Na_2CO_3) commences at 370° : $2SnO = SnO_2 + Sn$ (cf. A., 1928, 257). No transition is observed at 550° (cf. A., 1933, 214).   A. J. E. W.

Corrosion of metallic tin [by sulphur dioxide].—See B., 1939, 617.

Ageing and coprecipitation. XXVII. Coprecipitation of nitrate with lead sulphate and the decomposition of coprecipitated nitrate on heating. I. M. KOLTHOFF and R. A. HALVERSEN (J. Physical Chem., 1939, **43**, 605—611).—When equimol. solutions of $Pb(NO_3)_2$ and K_2SO_4 (0·4—0·025 mol.) are mixed at room temp., the amount of co-pptd. nitrate is 0·5—0·6%. The amount is less if K_2SO_4 is added to an excess of $Pb(NO_3)_2$, if pptn. takes place at 100°, or if the solution of $Pb(NO_3)_2$ is slightly acidified with HNO_3. The nitrate is not copptd. as KNO_3 but as $Pb(NO_3)_2$ or a basic salt. The amount of copptd. nitrate decreases on ageing the ppt., and almost the whole of it is eliminated after ageing for 24 hr. in 0·01N-HNO_3 at 90°.   C. R. H.

Mechanism of the corrosion of thallium. E. PLANK and A. URMÁNCZY (Z. anorg. Chem., 1939, **241**, 158—164; cf. A., 1938, I, 405).—The rate of corrosion of rotating Tl discs in H_2O $\propto$ the speed of rotation when the H_2O is in equilibrium with air. In presence of O_2 the rate is much increased; in pres-

ence of H_2 it is much diminished and increases only slightly with increasing speed of rotation. The rate is always $\ll$ if the controlling factor were the diffusion of TlOH from a limiting concn. (= its solubility) on the surface. The fact that the metal is functioning simultaneously as a Tl electrode and a H electrode defines its potential, and from this it is calc. that the limiting [Tl·] = [OH'] is $\ll$ the solubility of TlOH. O_2 accelerates the corrosion by disturbing the H potential on the surface of the metal.   F. J. G.

Reaction of phosphoric acid with trioxymethylene.—See A., 1939, II, 303.

Octahedral arsenious oxide. M. RANDALL and T. C. DOODY (J. Physical Chem., 1939, **43**, 613—622).—The formation of planar and needle-like octahedral crystals of As_2O_3, prepared by mol. distillation in vac. under varying conditions, is described.
C. R. H.

Niobium tetroxide. P. SÜE (Bull. Soc. chim., 1939, [v], **6**, 823—829).—Nb_2O_4 is most easily prepared by reduction of Nb_2O_5 in H_2 at 800—1000°. It is not attacked by $Br-H_2O$, H_2O_2, conc. aq. $KMnO_4$, conc. or dil. aq. NaOH, HNO_3, HF, HCl, or H_2SO_4 in the cold or in the hot. When heated in air it remains unchanged at <390° but at 400° it burns with incandescence, forming Nb_2O_5. In O_2 oxidation begins at 200°. When heated with Na_2CO_3 it yields $NaNbO_3$ and CO. Similar reducing action is observed when it is heated with $NaNO_3$, $NaNO_2$, NaOH, Na_2SO_3, or Na_2SO_4. Nb_2O_4 reduces CO_2 at 900—950°, SO_2 at 320—365°, and NO_2 at 210°, producing CO, S, and NO, respectively.   J. W. S.

Niobium chlorides. P. SÜE (Bull. Soc. chim., 1939, [v], **6**, 830—837).—The action of Cl_2 on a mixture of Nb_2O_5 and C yields a mixture of $NbCl_5$ and $NbOCl_3$. When the vapours so obtained are mixed with Cl_2 and passed over C heated at 700° pure $NbCl_5$ is obtained. Oxidation of $NbCl_5$ at ~300° produces $NbOCl_3$ but at ~500° Nb_2O_5 is formed. When a mixture at H_2 and $NbCl_5$ vapour is passed through a tube heated at 400—450° $NbCl_3$ is formed. $NbCl_3$ burns in air forming $NbOCl_3$. Nb_2O_4 reacts readily with Cl_2 forming a mixture of Nb_2O_5 and $NbCl_5$.
J. W. S.

Exchange reactions with radio-sulphur. H. H. VOGE (J. Amer. Chem. Soc., 1939, **61**, 1032—1035).—Radio-S (S*), prepared by (i) $^{35}_{17}Cl + ^{1}_{0}n = ^{35}_{16}S + ^{1}_{1}H$ and (ii) $^{34}_{16}S + ^{2}_{1}D = ^{35}_{16}S + ^{1}_{1}H$, was dissolved in O_2-free NH_4 sulphide solution, acidified, and the H_2S formed passed into $Pb(OAc)_2$. S was oxidised and pptd. as $BaSO_4$. Activities measured by a Geiger counter indicated complete and rapid exchange. The exchange HS*' + S_2O_3'' $\rightleftharpoons$ HS' + S*SO_3'' is slow at room temp.; even at 100° for 1 hr. it is not complete, but after 24 hr. at 100° it is practically complete. No exchange occurred at 20° in S*O_3'' + S_2O_3'' $\rightleftharpoons$ S*SO_3'' + SO_3'' but after 21 hr. at 57° or 1 hr. at 100° there was complete exchange. After 36 hr. at 100° there was no exchange in S*O_4'' + S'' (alkaline solution) nor in S*O_4'' + SO_3'' (alkaline or acid solution). At temp. < temp. of dissociation of SO_3, S*O_2 and SO_3 do not exchange even in presence of H_2O or Pt–asbestos.   W. R. A.

Sulphur tetroxide (SO_4). F. FICHTER and A. MARITZ (Helv. Chim. Acta, 1939, **22**, 792—797).—Mixtures of SO_4 and SO_3 (>75 mol.-% SO_4) can be produced by passing a mixture of SO_2 and O_2 through an ozoniser (cf. Schwarz and Achenbach, A., 1934, 1183). When dissolved in aq. $KHSO_4$ this product behaves similarly to the compound obtained by action of F_2 on $KHSO_4$ (A., 1927, 741), and passes gradually into $K_2S_2O_8$. Attempts to isolate SO_4F_2 indicate that if this compound exists it is non-volatile.
J. W. S.

Formation of aminomonopersulphuric acid by the interaction of fuming sulphuric acid and hydrogen azide. H. E. M. SPECHT, A. W. BROWNE, and K. W. SHERK (J. Amer. Chem. Soc., 1939, **61**, 1083—1086).—HN_3 vapour was absorbed in fuming H_2SO_4 at 60° or 80°. N_2 was liberated and aminomonopersulphuric acid, $NH_2·O·SO_3H$ (I), separated as colourless, orthorhombic crystals with truncated ends, deliquescent, easily sol. in H_2O, slightly sol. in MeOH and EtOH, insol. in $CHCl_3$ and CCl_4, m.p. (uncorr.) 210°. Aq. (I) is strongly acid and oxidises HI, $TiCl_3$, Fe··, and reduces MnO_4', CrO_4'', ammoniacal $AgNO_3$, and hot Fehling's solution. (I) forms a two-liquid solution with $COMe_2$. The crystals are stable to shock and friction; they decompose without violence on a hot Fe plate. The structure is probably (I) in equilibrium with NH,H_2SO_4 (monazenium sulphate). The reactions with HI, H_2O, NH_3, and EtOH have been quantitatively investigated. With NH_3 it is possible that diazene, $(NH)_2$, is formed. A mechanism for the formation of (I) is suggested.
W. R. A.

Mechanism of formation of polythionic acids. H. STAMM and M. GOEHRING (Naturwiss., 1939, **27**, 317—318).—Evidence in favour of the formation of thiosulphurous acid, $H_2S_2O_2$, as an intermediate product in the action of H_2S on SO_2 in aq. solution (Wackenroder's solution) is given. The following are important reactions of $H_2S_2O_2$ which, under suitable conditions, take place quantitatively: (1) $H_2S_2O_2 \rightarrow H_2S + SO_2$; (2) $H_2S_2O_2 + H_2S \rightarrow 3S + 2H_2O$; (3) $H_2S_2O_2 + 2HI \rightarrow I_2 + 2S + 2H_2O$. It follows that, contrary to the usually accepted view, $H_2S_2O_2$ is a powerful oxidising agent. To study (2) and (3) without the occurrence of (1) a non-aq. solvent must be used, the most suitable being HCO_2H. NH_3 is oxidised by $H_2S + SO_2$ and by $H_2S_2O_2$ in HCO_2H and in H_2O: (4) $H_2S_2O_2 + 2HN_3 \rightarrow 3N_2 + 2S + 2H_2O$. Hydrolysis of Me_2 thiosulphite by HCl in presence of H_2SO_3 gives $H_2S_4O_6$ in almost quant. yield: (5) $H_2S_2O_2 + 2H_2SO_3 = H_2S_4O_6 + 2H_2O$. With excess of H_2SO_3, and p_H 6·9, trithionate and thiosulphate are formed in equal proportions: (5a) $S_4O_6'' + SO_3'' = S_3O_6'' + S_2O_3''$. If H_2SO_3 is replaced completely or partly by $H_2S_2O_3$ in reaction (5), higher polythionic acids are formed. In Wackenroder's solution the presence of $H_2S_4O_6$ and $H_2S_3O_6$ can be explained by the occurrence of reactions (5) and (5a). Higher polythionic acids are due to the intermediate formation of $H_2S_2O_3$.   A. J. M.

Reactions of chromates at high temperatures. IX. Thermal decomposition of chromium trioxide. D. S. DATAR and S. K. K. JATKAR (J. Indian

Inst. Sci., 1939, **22**, A, 119—126; cf. A., 1939, I, 333).—The thermal decomp. of CrO_3 in a closed system proceeds in stages with the formation of intermediate products : (i) 250°, 25% decomp. corresponding with Cr_8O_{21}; (ii) 286°, 33·3% decomp., Cr_6O_{15}, stable up to 290°; (iii) 346°, 40% decomp., Cr_5O_{12}, stable up to 249°; (iv) 357°, 50% decomp., Cr_4O_9, unstable. Each intermediate compound is characterised by a distinctive rate of decomp. and heat of activation. The data agree with those on the decomp. of mixtures of alkaline-earth chromates with the corresponding oxides. No evidence was obtained for the formation of intermediate compounds at 28·86, 66, 75, and 80% decomp.   W. R. A.

Reduction of allotropic forms of manganese dioxide by hydrogen. J. M. DUNOYER (Compt. rend., 1939, **208**, 1018—1020).—The reactions have been studied by observing the change of the H_2 pressure with steadily rising temp. Reduction commences at ~170° with α-MnO_2, and at ~220° with β-MnO_2, which is prepared only by heating $Mn(NO_3)_2$. Mn_2O_3 is first formed, and is reduced further at >~260°. Mn_3O_4 reacts on formation and gives no break in the p-θ curve; reduction of pure Mn_3O_4 commences at 350°. The final reduction product is pyrophoric MnO.   A. J. E. W.

Rhenium-blue. W. BILTZ, F. W. WRIGGE, and K. MEISEL (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., III, 1936, **1**, 161—173; Chem. Zentr., 1936, ii, 3770—3771).—" Re-blue," obtained by thermal decomp. of Re_2O_7 in a vac., reduction of Re_2O_7 with SO_2 and S, or CO, or by reduction of colloidal Re_2O_7 in H_2SO_4 solution, is shown by analysis and X-ray examination to be identical with ReO_3, which may be dark blue to copper-coloured, according to the state of division. The product obtained with SO_2 and S contains varying amounts of S, the sum of the at. proportions of S and O being ~3. Reduction with CO readily gives Re.   A. J. E. W.

Decomposition of ferrous oxide.—See B., 1939, 611.

Corrosion of iron and steel.—See B., 1939, 614.

Action of pyridine and ammonia on complex ammines of benzidine. G. SPACU and C. G. MACAROVICI (Bull. Acad. Sci. Roumaine, 1939, **20**, 11—23).—Treatment of $CoBzdCl_2$ [Bzd = p-$(C_6H_4\cdot NH_2)_2$] with C_5H_5N in light petroleum yields the *complex* $[CoBzd(C_5H_5N)_2]Cl_2$. Similarly are formed the *complexes* $[ZnBzd(C_5H_5N)_2]$ and $[CdBzd(C_5H_5N)_2]Cl_2$. $ZnBzdCl_2$ and $CdBzdCl_2$ with NH_3 in light petroleum yield respectively the *complexes* $[ZnBzd(NH_3)_2]Cl_2$ and $[CdBzd(NH_3)_2]Cl_2$.   J. D. R.

Dehydration of double cobalt potassium sulphate. (MME.) N. DEMASSIEUX and B. FEDOROFF (Compt. rend., 1939, **208**, 1223—1225).—Discontinuities in the loss of H_2O during slow heating of $CoSO_4,7H_2O$ show the existence of hydrates with 6, 4, 2·5, and $1H_2O$; dehydration commences at 20°, and is complete at 285°. $K_2Co(SO_4)_2,6H_2O$ loses H_2O at >75°; a dihydrate, stable at 120—150°, gives the anhyd. salt at 200°, and the latter regains $6H_2O$ on exposure to the atm. at room temp. Debye–Scherrer

diagrams (which are reproduced) show corresponding changes, and indicate a transition in $K_2Co(SO_4)_2$ at 300°.   A. J. E. W.

[Spot] reactions in qualitative analysis. E. JENSEN (Tids. Kjemi, 1939, **19**, 57—60, 75—77).—A review.   M. H. M. A.

Destruction of dilute oil hydrosols in volumetric analysis. D. F. CHEESMAN (Analyst, 1939, **64**, 344).—The hydrosol is shaken with ~25 vol.-% of a partly sol. alcohol (e.g., amyl). On keeping, the alcohol and dissolved oil rise to the surface, leaving the aq. phase clear.   E. C. S.

Determination of radioactive isotopes in organic material.—See A., 1939, II, 351.

Electrochemical measurement of concentrations (other than p_H) by formation of galvanic cells. F. LIENEWEG (Arch. tech. Mess., 1936, Part 61, T90—91, 4 pp.; Chem. Zentr., 1936, ii, 3928).—The determination of cations, anions, CO_2, and oxidising and reducing agents by potential measurements, and of oxidising agents by current measurements on polarised cells, are discussed.   A. J. E. W.

Theory of differential potentiometric titration. L. GIRAUT-ERLER (Compt. rend., 1939, **208**, 1220—1222; cf. A., 1925, ii, 999; 1929, 1410).—Complete formulæ are given for the p_H differences at each stage in the titration of strong acids and bases in terms of the concns. and vols. of the solutions and the [H˙][OH′] product for H_2O. The formulæ are verified by e.m.f. measurements during differential titration of 0·01—1N-HCl and -NaOH in the cell $Pt-H_2|HCl|KCl(satd.)|HCl|Pt-H_2$.   A. J. E. W.

Theory of differential potentiometric titration of acids and weak bases. L. GIRAUT-ERLER (Compt. rend., 1939, **208**, 1399—1401).—An extension of previous work (preceding abstract).   W. R. A.

Determination of hydrogen in steel.—See B., 1939, 615.

Bromo-iodometric investigations. X. Determination of both constituents in an iodate-bromate mixture. J. H. VAN DER MEULEN (Chem. Weekblad, 1939, **36**, 414—416).—IO_3' is treated with KI in a solution rendered acid with $Al_2(SO_4)_3$, $AlCl_3$, or KHF_2. The liberated I is titrated with $Na_2S_2O_3$ solution, HCl is added to bring about reaction between KI and BrO_3', and the I equiv. to the BrO_3' is titrated with $Na_2S_2O_3$ solution.   S. C.

Iodometric standard of high equivalent weight. G. VAVRINECZ (Magyar chem. Fol., 1936, **42**, 1—2; Chem. Zentr., 1936, ii, 1029).—Very dil. (~0·02N.) $Na_2S_2O_3$ is conveniently standardised with $(NH_4)_2CuCl_4,2H_2O$ (I) (equiv. wt. 277·51), which is stable in air and retains its H_2O over $CaCl_2$ at room temp. A weighed amount of (I) is titrated immediately after dissolution in 1—2 c.c. of H_2O and addition of 0·5 g. of KI; AcOH is also added if the $Na_2S_2O_3$ contains an alkaline preservative.   A. J. E. W.

Determination of fluorine in wood preservation technique. I. Analysis of fluorides in aqueous solution. B. IKERT (Chem.-Ztg., 1939, **63**, 324).—The alkali fluoride is converted into H_2SiF_6

by addition of aq. Na_2SiO_3 and a slight excess of HCl. H_2SiF_6 is pptd. by KCl and EtOH, and the K_2SiF_6 is treated with hot H_2O and titrated with $0.1N$-NaOH (phenolphthalein). When CrO_4'' and AsO_4''' are present in the alkali fluoride solution, contamination of the K_2SiF_6 by an insol. compound of Cr^{III} and As, which leads to high results, is avoided by increasing the acidity of the solution, and by quick filtration in absence of direct sunlight. The time required for a determination is 35—40 min., and the errors are $\pm 0.5\%$, and in presence of AsO_4''' and CrO_4''', $\pm 1\%$.
L. S. T.

Washing and separation of barium sulphate in the micro-gravimetric determination of sulphur. R. GRANGAUD (Mikrochem., 1939, **27**, 52—56).—The org. substance is decomposed and the S pptd. as $BaSO_4$ in the usual way. The ppt. is stirred with 1% HCl and transferred to a weighed SiO_2 test-tube by alternate rinsing with EtOH and 1% HCl. After centrifuging the supernatant liquid is removed by suction. The ppt. is stirred with 1% HCl, centrifuged, and the liquid removed by suction a further 3 times before the tube containing the ppt. is dried, heated to redness, cooled, and weighed. J. W. S.

Determination of sulphur in iron and steel.—See B., 1939, 615.

Determination of gaseous sulphur dioxide in presence of sulphuric acid mist and nitrogen oxides.—See B., 1939, 599.

Determination of sulphur dioxide in air.—See B., 1939, 671.

Stannous chloride as quantitative reagent for selenium and tellurium. W. R. SCHOELLER (Analyst, 1939, **64**, 318—323).—If possible the material is dissolved in HNO_3; otherwise it is fused with Na_2O_2 and dissolved in HCl. Cu and NO_3', which interfere, are removed if present by pptn. of Se and Tc with aq. NH_3 on $Fe(OH)_3$. Se and Te are then pptd. with $SnCl_2$, the ppt. is dissolved in HCl–Br, and Se and Te are then separated by pptn. in two stages with SO_2. The application of the method to the determination of Se and/or Te in pyrites, CuS ores, stibnite, liquated sulphide (crudum), Sb, oxidised Sb ores, refined Cu, Pb, and galena, oxidised ores etc., electrolytic sludge, and chamber mud is described.
E. C. S.

Mechanism of the catalytic action of selenium in the Kjeldahl nitrogen determination. A. SREENIVASAN and V. SADASIVAN (Z. anal. Chem., 1939, **116**, 244—252).—The reactions between hot, conc. H_2SO_4 and Se, SeO_3'', or SeO_4'' in presence of K_2SO_4, and the effects produced by the addition of HgO and org. substances, have been investigated. When Se or SeO_3'' reacts with conc. H_2SO_4, the stable compound formed is H_2SeO_3. With H_2SeO_4 and H_2SO_4, the former is readily reduced to H_2SeO_3. In presence of HgO, H_2SeO_4 only is formed. In presence of reducible org. substances and without HgO, small quantities of H_2SeO_3 are formed when Se is added to hot, conc. H_2SO_4; H_2SeO_3 is partly reduced to Se, and H_2SeO_4 completely to $H_2SeO_3 + Se$. In presence of HgO, H_2SeO_4 is formed even when org. substances are present. With HgO and Se, the decomp. of rice flour,

oil cake, dried blood, etc. is effected in a third of the time required with Se alone. The catalytic effect of the Se is greatest during the early stages of oxidation of org. materials. In presence of HgO, this action is attributed to the reaction $Se \rightarrow H_2SeO_3 \rightleftharpoons H_2SeO_4$, whilst in its absence the reaction $Se \rightleftharpoons H_2SeO_3$ is responsible for the oxidation of org. substances.
L. S. T.

Determination of nitrogen in complex cyanides of heavy metals. V. E. TISCHTSCHENKO and A. M. SAMSONIA (J. Appl. Chem. Russ., 1939, **12**, 155—160).—The N content of ferri-, mercuri-, argenti-, cobalti-, and nickeli-cyanides is determined, with an error of 0.02—0.09%, by heating for 1 hr. at 270° (sealed tube) with 1 : 4 HCl, followed by Kjeldahl distillation of the NH_3 formed. With 1 : 4 H_2SO_4 in place of HCl the error is 0.04—0.24%. R. T.

Determination of nitrogen in cider and apple juice.—See B., 1939, 651.

Specific test for nitrates. M. PESEZ (J. Pharm. Chim., 1939, [viii], **29**, 460—465; cf. Janovski, A., 1891, 685).—Nitrates convert $PhNO_2$ in conc. H_2SO_4 into m-$C_6H_4(NO_2)_2$ which yields an intense violet colour (later blood-red) when treated with $COMe_2$ and NaOH. If C_6H_6 replaces $PhNO_2$ the mixture must be heated to 100°. 10 μg. of KNO_3 can be detected (pink colour). The stability of the colour is increased by reducing the H_2O content of the mixture. W. McC.

Colorimetric determination of nitrates in water.—See B., 1939, 673.

Determination of nitric oxide in coal-distillation gases.—See B., 1939, 568.

Detection of ammonia, calcium, and strontium with organic nitro-compounds. R. FISCHER (Mikrochem., 1939, **27**, 67—75).—A drop of saturated picric acid (I) in $CHCl_3$ is evaporated to dryness on a microscope slide, moistened with H_2O, and exposed to the vapours suspected to contain NH_3. To prevent interference by amines these are preferably liberated by MgO rather than NaOH. After absorption of the gases the H_2O on the slide is evaporated to dryness and the residue washed with $CHCl_3$ to remove (I). NH_4 picrate is insol. and remains on the slide. Its presence can be confirmed by its ready sublimation at 170—180° and micro-m.p. determinations. The method permits detection of 0.1 μg. of NH_3. Amines also yield salts with (I) under these conditions but they are either sol. in $CHCl_3$ or are non-sublimable. Styphnic acid ppts. NH_3 from aq. solution. After sublimation in a vac. the NH_3 styphnate forms prisms, m.p. 252—254°. The NH_4 compound of dinitro-α-naphthol forms dark yellow needles, m.p. 179—180°, insol. in $CHCl_3$ but decomposed on sublimation. NH_4 picrolonate is insol. in $CHCl_3$ and on sublimation in a vac. forms long pointed needles, m.p. 252—254 (decomp.). Ca and Sr form characteristic cryst. picrolonates when a slightly acid solution is evaporated to dryness with picrolonic acid. They are insol. in $CHCl_3$ and H_2O and are therefore left when the residue is washed with these solvents. Both lose H_2O of crystallisation at 80°, but the Ca salt has m.p.

250—270°, whereas the Sr salt is infusible at <350°. 0·2 μg. of Ca or Sr can be detected by this method.
                J. W. S.

Elimination of the phosphate ion in qualitative analysis by ignition. C. H. LIBERALLI (Rev. Soc. Brasil. Quím., 1938, **7**, 149—153).—A solution of cations, from which groups 1 and 2 have been removed, together with excess of Na_2CO_3 is evaporated, fused, and lixiviated, whereby PO_4''' is dissolved. Metals with sol. and insol. carbonates can then be separately identified. The advantage of speed and simplicity is claimed for the method. F. R. G.

Microchemistry of yohimbine.—See A., 1939, II, 352.

Rapid qualitative analysis of silicates. A. CHAUDET (Anal. Asoc. Quím. Argentina, 1938, **26**, 269—273).—The sample (1 g.) with Mg powder (0·5 g.) is fused in a Ni or Fe crucible and extracted successively with H_2O and aq. HCl. The presence of Na, K, Li, Be, and Al can be detected in the solutions.
                F. R. G.

Determination of silica in Portland cement.—See B., 1939, 607.

Conductometric determination of carbon dioxide. A. BEILER and E. SCHRATZ (Jahrb. wiss. Bot., 1937, **85**, 355—367).—Modification of the method of Holdheide *et al.* is described. A. G. P.

Analysis of mixtures of ethylene oxide and carbon dioxide.—See B., 1939, 576.

Separation of cations by extraction. S. STENE (Tids. Kjemi, 1939, **19**, 6—7).—Cations are selectively extracted from aq. solution by acetylacetone in $CHCl_3$ or CCl_4, and then re-extracted from the org. liquid by conc. HCl. Apparatus is described.
               M. H. M. A.

Determination of alkali metals by Lawrence Smith's method. W. VAN TONGEREN (Zentr. Min., A, 1936, 243—245; Chem. Zentr., 1936, ii, 3929).—The following modification is proposed : 0·5 g. of $CaCO_3$ is treated with conc. HCl in an agate mortar, leaving a small residue, and the silicate powdered under the resulting liquid. The $CaCO_3$ required for decomp. is added, and the mixture moistened with EtOH. After drying and fusion for 30—45 min. the cooled melt disintegrates in hot H_2O in <1 hr.
               A. J. E. W.

Use of base–exchange substances in analytical chemistry. I. O. SAMUELSON (Z. anal. Chem., 1939, **116**, 328—334).—$Na^{\cdot}$ and Cl', SO_4'', NO_3', and HPO_4'' can be separated quantitatively from the orresponding aq. salt solutions by passage through a powdered, $H^{\cdot}$-ion saturated, sulphonic acid-permutit, and the HCl, H_2SO_4, HNO_3, and H_3PO_4 determined in the filtrate by standard alkali. Other quant. separations are $Cu^{\cdot\cdot}$ from NO_3', $Cr^{\cdots\cdot}$ from SO_4'', $Fe^{\cdots}$ from Cl', $V^{\cdots\cdot}$ from SO_4, $Fe^{\cdot\cdot}$ from aq. $FeSO_4$,$(NH_4)_2SO_4$,$6H_2O$, and $Fe^{\cdots} + Mg^{\cdot\cdot}$ from $SO_4'' + PO_4''' + H_2SO_4$. The passage of $Fe_2(SO_4)_3 + CuCl_2 + HCl$ through a Na-permutit completely removes $Fe^{\cdot\cdot}$ and $Cu^{\cdot\cdot}$ and leaves the filtrate neutral. Treatment of the permutit with N-HNO_3 then gives a solution which shows no reaction for Cl'. Possible advantages to be gained from the application of these

separations to ordinary analytical processes, *e.g.*, in the determination of SO_4'' in presence of ions that interfere with the $BaCl_2$ pptn., and the removal of $H^{\cdot}$ and heavy metal ions before a Mohr titration for Cl', are pointed out. The stability of the new org. permutits towards acids makes these separations possible.   L. S. T.

Reactions of oximino-3-methyl-5-pyrazolone with metallic salts. V. HOVORKA and V. SÝKORA (Coll. Czech. Chem. Comm., 1939, **11**, 124—127).—An aq. EtOH solution of oximino-3-methyl-5-pyrazolone forms ppts. with salts of Ag, Hg^I, Hg^{II}, and Cu. The composition of the Cu ppt. corresponds with $Cu(C_4H_4O_2N_3)_2$.   D. F. R.

Determination of calcium by means of loretine. N. SCHWORL (Pharm. Weekblad, 1939, **76**, 620—625).—2·5 c.c. of the solution (containing <2% of Ca and free from metals other than Mg, Na, K) are treated with 2·5 c.c. of buffer solution (25% AcOH + 10% cryst. NaOAc) and warmed in a H_2O-bath. 25 c.c. of 0·1N-Na 7-iodo-3-hydroxyquinoline-5-sulphonate (meditrene) (I) are heated to boiling and added to the mixture, which is boiled for 15 min. and slowly cooled. Next day the $3[Ca(OH)\cdot C_9H_4NI\cdot SO_3)_2]$,$10H_2O$ is filtered off (3G3 filter), washed successively with 3 c.c. of (I), 2×3 c.c. of EtOH, and 3 c.c. of $COMe_2$, and dried at 80°. The conversion factor ppt./Ca is const. at 21—20 with 2—40-mg. Ca. S. C.

Micro-separations of zinc by 8-hydroxyquinoline. IV. Zinc from manganese, iron, bismuth, mercury, arsenic, and antimony. C. CIMERMAN and P. WENGER (Mikrochem., 1939, **27**, 76—84; cf. A., 1938, 270).—Zn cannot be separated from Mn by a single pptn. by the AcOH method. The ppt. is redissolved in HCl and NaOH is added until a turbidity is produced. AcOH and NaOH are then added and the Zn is repptd. In determining Zn in alkaline medium in presence of Fe^{III}, bromothymol-blue is used instead of Me-red as indicator for neutralisation of tartaric acid, and heating is carried out at 120—130° instead of 200°. In presence of Bi the alkaline method is modified by using a preliminary washing of the ppt. with dil. 8-hydroxyquinoline solution containing tartaric acid and NaOH. In presence of Hg^{II} 1 mg. of KCN is added per mg. of Hg present. Zn can be determined in alkaline solution in presence of $\not> 8$ mg. of As^{III} or As^V or 20 mg. of Sb^{III} of Sb^V if heating is carried out at 120—130°. Attempts to adapt the methods for determination of Zn in presence of Ni and Co have been unsuccessful.
               J. W. S.

Micro-gravimetric separation of zinc and uranium. E. KROUPA (Mikrochem., 1939, **27**, 1—7).—The Zn and U are converted into the chlorides and 2N-aq. Na_2CO_3 is added till a permanent ppt. appears. 0·5 c.c. of 2N-$CH_2Cl\cdot CO_2H$ and 0·5 c.c. of N-NaOAc are added to dissolve the ppt., and the solution is made up to 8 c.c. A stream of H_2S is passed through the hot solution for 10 min., and, after keeping for 10 min., the ZnS is collected and washed with H_2O containing $CH_2Cl\cdot CO_2H$ and NaOAc and saturated with H_2S. The filtrate is boiled to remove H_2S and its vol. reduced to 2·5—3 c.c. It is then neutralised with NH_3 and then 1 drop of HCl is added,

together with 0·5 c.c. of 50% NH_4OAc. After warming, 100% excess of 8-hydroxyquinoline (4% in 8% aq. AcOH) is added to ppt. U, the free acid introduced being neutralised by adding 2 drops (0·05 c.c.) of 12% NH_3 per 0·5 c.c. of reagent. After 10 min. on the H_2O-bath the ppt. is collected and dried at 136—138°. The ZnS ppt. is dissolved in HCl, the solution evaporated to dryness, and the residue taken up in HCl (2 drops) and hot H_2O (1·5 c.c.). It is transferred to a weighed micro-filter vessel, made up to 5 c.c., and neutralised with NH_3. After making slightly acid with 1 drop of HCl, 0·1 g. of NH_4Cl and a 20-fold excess of $(NH_4)_2HPO_4$ are added. The mixture is heated (H_2O-bath) for ½ hr., filtered, and the ppt. washed 4 times with 1% $(NH_4)_2HPO_4$ before drying at 103°.   J. W. S.

Quinaldinic acid as a micro-reagent. IV. Determination of zinc in presence of copper or of silver and mercury. P. R. RÂY and T. C. SARKAR (Mikrochem., 1939, 27, 64—66; cf. A., 1935, 1094; 1939, I, 157).—In presence of Cu the solution is treated with 20% $NaHSO_3$ and glacial AcOH (0·05 c.c.) and 10% $CS(NH_2)_2$ (1—1·5 c.c.) are added. After warming to redissolve the ppt. which forms, Zn is pptd. by addition of excess of Na quinaldinate. After filtration through an asbestos-packed filter-stick and drying at 125° the ppt. is weighed as $Zn(C_{10}H_6O_2N)_2,H_2O$. In presence of Ag and Hg the treatment with $NaHSO_3$ is omitted.   J. W. S.

Specificity of the determination of lead with dithizone particularly in presence of thallium and bismuth. J. F. REITH and C. P. VAN DIJK (Chem. Weekblad, 1939, 36, 341—343).—Sn, Zn, and Tl do not interfere with the determination of Pb in urine by the dithizone (I) method provided precautions (A., 1938, III, 919) are taken. Bi may interfere and is detected qualitatively by treating the CN-free solution of the nitrates with a little (I) at p_H 4·0. An orange-red or dirty violet-red colour of the $CHCl_3$ layer indicates Bi. After destruction of the urine and addition of KCN and citrate the solution is adjusted to p_H 8·5 and treated with (I). The combined $CHCl_3$ extracts are washed with 50 c.c. of H_2O, and then with 20 c.c. of 1% HNO_3. The HNO_3 solution is washed with $CHCl_3$, adjusted to p_H 4·0 (NH_3 and bromocresol-green), and treated repeatedly with (I) until Bi is removed [colour of $CHCl_3$ solution of (I) remains green]. Excess (I) is then removed, the solution is adjusted to p_H 7·5 by adding KCN, and the Pb titrated with (I).   S. C.

Polarographic studies with the dropping mercury electrode. IX. Titrations with precipitations and redox reactions. M. SPÁLENKA (Coll. Czech. Chem. Comm., 1939, 11, 146—164; cf. A., 1936, 579).—Titrations with Pb and SO_4, Zn, and $Fe(CN)_6''''$, and titanometry with $Fe^{...}$, Cr_2O_7, ClO_3, BrO_3, IO_3, and $Fe(CN)_6'''$ have been carried out with the dropping Hg electrode, the end-point being determined polarographically or polarometrically. With the redox reactions it is better to use an electrolysis vessel with a Hg layer at the bottom, serving as the unpolarisable electrode, instead of a separate reference electrode.   D. F. R.

Determination of lead in driers.—See B., 1939, 629.

Sensitive micro-test for thallium. H. JURÁNÝ (Mikrochem., 1939, 27, 8—13).—A drop of the neutral or slightly acid solution is diluted with H_2O (2 c.c.), heated to the b.p., and treated with K_2HgI_4 reagent (HgI_2 3·3 g. and KI 2·7 g. dissolved in hot H_2O 3—4 c.c. and diluted to 15 c.c.) until the solution has a yellowish colour. In presence of Tl a yellowish-orange turbidity develops, the crystals growing as the solution cools and appearing microscopically as yellow rectangular or rod shapes often grouped in crosses or star-shaped clusters. They are tetragonal, exhibit straight extinction, and are optically positive. With very low Tl content the test may be performed on a microscope slide. The limit of detection is 0·1 μg. of Tl, and the limiting concn. 5 μg. per c.c. Ag, Pb, Sn^{II}, and As^{III} interfere with the test. K_2HgI_4 yields yellowish-green ppts. with conc. Pb^{II} solutions, conc. CsCl, and with solutions containing CsCl and RbCl.   J. W. S.

1 : 2-Diaminoanthraquinone-3-sulphonic acid as a reagent for copper in drop analysis. H. E. BALLABAN (Mikrochem., 1939, 27, 57—63).—Reagent paper is prepared by soaking strips of filter-paper in 0·05% aq. 1 : 2-diaminoanthraquinone-3-sulphonic acid and drying at room temp. A drop of neutral or slightly acid solution is spotted on the reagent paper and almost dried off by warming. The paper is then spotted with N-NaOH when, according to the amount of Cu present, a blue spot or ring is produced. The test can also be carried out directly with solutions containing NH_3. Ni and Co yield greenish-blue and dark blue colours, respectively, with the reagent. In presence of these metals the test solution is put on a strip of filter-paper which, after drying, is spotted with aq. KCNS containing SO_2 and dried again. On washing in H_2O the Cu remains in the paper as CuCNS. After drying, the paper is spotted with the reagent and with NaOH. The application of the method to the detection of Cu in minerals and alloys is discussed. The limit of detection is 0·02 μg. of Cu.   J. W. S.

Determination of copper in hay by the diethyl-dithiocarbamate method. F. NYDAHL (Z. anal. Chem., 1939, 116, 315—328).—Data for the absorption of light by CCl_4 solutions of Cu diethyldithiocarbamate (I) show a max. at 434 mμ. CCl_4 is preferable to $C_5H_{11}·OH$ for extraction, and when it is used repeated extractions are unnecessary (cf. A., 1932, 1011). The extinction coeff. of solutions of (I) in CCl_4 falls only slightly with an increase in concn. of (I), and in most cases this fall can be disregarded. Washing with dil. aq. NH_3 has no effect on solutions of (I) in CCl_4, and removes interference by Fe and Mn. Measurements of the extinction coeff. of (I) extracted by CCl_4 by the method given yield good results for $\ll 2$ μg. from 5 g. of hay. The extinction coeff. of CCl_4 solutions of (I) kept in a dark room for 1 day remained unchanged. Ni and Co, but not Ti, Pb, and Ce^{III}, affect the colour of CCl_4 solutions of (I), but, in the amounts in which they occur in plants, are unlikely to invalidate the determination of Cu by this method. The amounts of Pt introduced by

working with Pt apparatus can also be disregarded. A wet combustion of the hay, with HNO_3 and H_2SO_4 and finally by $HClO_4$, is preferred. This is followed by treatment with citrate solution and aq. NH_3, addition of carbamate solution, and extraction with CCl_4. SiO_2 and $CaSO_4$ need not be removed.

L. S. T.

Cupferron and neo-cupferron, their preparation, properties, and analytical applications. G. F. SMITH (Separate, Columbus, 1938, 47 pp.).

Iodometric–oxidimetric evaluation of aqueous mercury chloride solutions. H. STÄGLICH (Süddeuts. Apoth.-Ztg., 1939, 79, 397—398).—Published methods are reviewed and modified D.A.B. VI methods using Na_3AsO_3 and $KHCO_3$ for decomp. are recommended for the determination of 1% and 5% Hg_2Cl_2 solutions.   E. H. S.

Microchemistry of the rare earths. G. BECK (Mikrochem., 1939, 27, 47—51).—Sc and Th yield with Na alizarin-3-sulphonate ppts. which are insol. in dil. AcOH, whilst other rare-earth metals are not pptd. so long as the solution is not unduly conc. This method permits the separation of Sc and Th from other rare-earth metals in one operation. The rare earths and Zr compounds yield violet solutions with tincture of cochineal, whereas Th gives blue solutions. The colour of solutions of the Ce earths (La—Sm) becomes reddish-orange on adding dil. AcOH, whereas with the Tb and Er earths and Zr conc. AcOH is required to cause the change.

J. W. S.

Colorimetric determination of cerium. E. PLANK (Z. anal. Chem., 1939, 116, 312—315).—The determination is based on the strong colours given by solutions of K percericarbonate. The slightly acid Ce solution is treated with conc. aq. K_2CO_3, diluted accurately with H_2O, and shaken with O_2 until the colour remains unchanged. The extinction coeff. is then found by means of a Pulfrich step-photometer. Beer's law is valid. This determination of Ce cannot be made directly in presence of Fe, Co, Ni, Cr, V, Pr, Nd, Er, Au, or Pd which give coloured solutions with excess of conc. aq. K_2CO_3. When H_3AsO_3 is present, $Ce^{\cdots}$ is oxidised only to $Ce^{\cdots\cdots}$ which cannot be oxidised to a perceric compound by air or O_2.   L. S. T.

Specific reagent for ceric salts. E. MONTIGNIE (Bull. Soc. chim., 1939, [v], 6, 889).—p-$NH_2 \cdot C_6H_4 \cdot SO_3H$ (0.5 g.) in H_2SO_4 (5 c.c.) in H_2O (100 c.c.) yields an immediate red colour with conc. solutions of Ce^{IV} salts. With dil. solute solutions it is necessary to warm the solution. The limit of sensitivity is 20 mg. per l. The colour disappears on addition of NaOH and is insol. in Et_2O. OCl', OBr', and BrO_3' ions yield a yellow colour with the reagent in the cold, whilst S_2O_8'' and IO_4' yield a red colour on warming, but this is always less intense than with Ce^{IV}.   J. W. S.

Determination of aluminium in ferrous alloys. —See B., 1939, 615.

Separation of manganese from aluminium and iron salts and the volumetric determination of these metals. W. DAUBNER (Z. anal. Chem., 1939, 116, 309—311).—In a HCl solution of Fe, Al, and Mn, the $Fe^{\cdots}$ is determined as described previously (A., 1936, 580). Fe and Al are eliminated from another aliquot portion as $Fe_2(HAsO_4)_3$ and $AlAsO_4$ (loc. cit.), and the AsO_4''' is determined iodometrically. When Al only is to be determined the $Fe^{\cdots}$ is reduced to $Fe^{\cdot\cdot}$ by means of SO_2, the Al pptd. as $AlAsO_4$, and determined as above. The filtrate containing Mn and AsO_4''' is reduced by SO_2, and the NH_4 salts and $As^{\cdots}$ are removed by evaporation and ignition. The Mn in the residue is dissolved in HCl, the solution conc. to remove Cl_2, the Mn pptd. as $MnNH_4AsO_4$, and the AsO_4''' content determined iodometrically.

L. S. T.

Elucidation of the macro- and micro-reaction of iron with thioglycollic acid. C. MAYR and A. GEBAUER (Z. anal. Chem., 1939, 116, 225—239; A., 1938, I, 474; II, 424).—The unstable, cornflower-blue compound obtained in the reaction between $FeCl_3$ and $SH \cdot CH_2 \cdot CO_2H$ (I) in dil. HCl is, in all probability, Fe^{III} thioglycollate (II). In moderately conc. HCl, no reaction between (I) and $Fe^{\cdots}$ takes place. (II) quickly decomposes into $Fe^{\cdot\cdot}$ and dithioglycollic acid (III). In absence of oxidising substances, $Fe^{\cdot\cdot}$ and (I) react with NaOH (or KOH) according to $Fe^{\cdot\cdot} + (I) + 2NaOH = CH_2{<}^{S}_{CO_2}{>}Fe$ (IV) $+ (I) + 2Na^{\cdot} + 2H_2O$, followed by (IV) $+ (I) + 2NaOH = Fe(S \cdot CH_2 \cdot CO_2Na)_2$ (V) $+ 2H_2O$. The ferrothioglycollate ion is colourless, and the red colour is due to undissociated (V). The colour of the alkali ferrothioglycollate solutions depends on the concn.; in concn. $> 0.2\%$, it is yellowish-red. The addition of MeOH to solutions of (V) changes the colour to red. Besides these ferrothioglycollates there is an intensely red-coloured complex, $[Fe^{II}(S \cdot CH_2 \cdot CO_2)_2]KFe^{III}$, formed by the reaction between $FeCl_3$ and $Fe(S \cdot CH_2 \cdot CO_2K)_2$, which can act catalytically as an O carrier in the oxidation of (I) to (III).   L. S. T.

Colorimetric determination of iron in glass using thioglycollic acid.—See B., 1939, 603.

Colorimetric titration [of iron in aluminium]. —See B., 1939, 618.

Spectrographic analysis of ferrous and non-ferrous metals.—See B., 1939, 615.

Analysis of chromite. M. BERTHET (Monit. Prod. chim., 1936, 18, No. 204, 3—4; Chem. Zentr., 1936, ii, 1032).—0.5 g. of the finely-powdered specimen is fused twice with 5—6 g. of Na_2O_2 over an EtOH flame (dull red heat), Na_2CO_3 being added for the second fusion. The aq. extract is treated with Na_2O_2 (1 g.) and $(NH_4)_2CO_3$, and boiled for 20 min. NH_4NO_3 (20 g.) is added to the filtrate, and SiO_2 and Al_2O_3 are removed by evaporating nearly to dryness, adding hot H_2O, and filtering. Cr and SO_4'' are determined in the filtrate, and SiO_2, Fe, Mn, Al, Ni, Ca, and Mg in the combined ppts.   A. J. E. W.

Inorganic spot analysis. F. FEIGL (Rec. trav. chim., 1939, 58, 471—480; cf. A., 1939, I, 94).—The following spot tests are described: W with diphenyline, Ca with diketosuccinnic osazone, Na with Zn uranyl acetate, N_2H_4 with salicylaldehyde, NH_2OH with salicylaldehyde and Cu acetate, HN_3 by the formation of

Ag or Fe azide, $[Fe(CN)_6]''''$ with uranyl acetate, $[Fe(CN)_6]'''$ with benzidine, ClO_3' and IO_3' by the formation of complex $[Mn(PO_4)_2]'''$, and SO_4'' with $BaCO_3$ and phenolphthalein. D. F. R.

Separation of uranium from manganese, zinc, calcium, strontium, barium, and magnesium by means of isatin-β-oxime. V. HOVORKA and J. VOŘÍŠEK (Coll. Czech. Chem. Comm., 1939, **11**, 128—145; cf. A., 1938, I, 270, 371; II, 377).—U may be separated by means of isatin-β-oxime from salts of Mn, Zn, Ca, Sr, Ba, and Mg. For 0·06—0·25 g. U_3O_8 the separation may be effected to within 0·09% from one metal, or 0·14% from mixtures of several metals. By using $(CH_2)_6N_4$ instead of NaOAc as buffer, separation from salts of the alkali metals may be effected. D. F. R.

Potentiometric titration of the stannite ion (SnO_2'') by alkali hypoiodite. G. SPACU and C. DRĂGULESCU (Bull. Acad. Sci. Roumaine, 1938, **20**, 1—10).—The potentiometric titration of the ion SnO_2'' by I in alkaline solution can be carried out on a microscale. Details are given and illustrated by reference to typical titrations. W. R. A.

Attempts to determine vanadium and the determination of chromium and molybdenum in steels [polarographically].—See B., 1939, 615.

Determination of vanadium in ferromanganese.—See B., 1939, 615.

Titration of bismuth with dithizone. J. P. REITH and C. P. VAN DIJK (Chem. Weekblad, 1939, **36**, 343—344).—Bi forms two dithizone compounds, respectively, deep red at p_H 7·5 and orange at p_H 4·0. It is removed quantitatively by extraction with dithizone solution (I) at p_H 4·0 in presence of an acetate buffer and provided citrate and CN' are absent. Under these conditions the method is sp. for Bi except when very large amounts of Pb are present. In this case the Bi + a little Pb are extracted with (I) at p_H 4·0, the $CHCl_3$ extract is extracted with 2 × 10 c.c. of 1% HNO_3, and Bi determined in the extract colorimetrically as quinine bismuthi-iodide. S. C.

Quantitative deposition of small amounts of gold from solution by micro-electrolysis. M. G. RAEDER and O. S. KYLLINGSTAD (Mikrochem., 1939, **27**, 112—117).—Electrolysis of aq. $AuCl_3$ containing KCl, using hard pencil lead as anode, and assay Pb wire as cathode, permits determination of 0·4—30 μg. of Au. After completion of electrolysis the Pb is removed and the residual bead of Au measured micrometrically. With a c.d. of 20—25 ma. per sq. cm. the time necessary for electrolysis is ≮20 min. at the b.p. and ≮4 hr. at room temp. J. W. S.

Thermometers for projection and direct reading of various sensitivities down to 0·02°. M. F. TABOURY and F. J. TABOURY (Bull. Soc. chim., 1939, [v], **6**, 838—840).—Thermometers constructed in clear glass of section similar to that used for clinical thermometers are described. With thermometers of this type graduated to 0·02° it is possible to project 1° scale reading to cover 1 m. J. W. S.

Temperature scale for the calibration of thermometers between 14° and 83° K. H. J. HOGE and F. G. BRICKWEDDE (J. Res. Nat. Bur. Stand., 1939, **22**, 351—373).—Seven resistance thermometers (six Pt; one 90 Pt : 10 Rh alloy) have been calibrated on the thermodynamic scale by comparison with a He gas thermometer. The b.p. of O_2 was taken as 90·19° K. and computations were made in such a way as to secure continuity between the International Temp. Scale and that being established. The triple point of normal H_2 is 13·96° and the b.p. 20·39° K. W. A. R.

Measurement of flame temperature.—See B., 1939, 568.

Measurement of specific heats of gases using very small rates of gas flow. L. AGOSTINI (Compt. rend., 1939, **208**, 1490—1492).—A modification of Blackett, Henry, and Rideal's apparatus (cf. A., 1930, 382) is described. The gas is passed (12 cu. mm. per sec.) through an electrically heated Ni tube, and the temp. of the two halves of the tube are compared by a resistance comparison on a Wheatstone bridge. A. J. E. W.

Simple method of reaching helium temperatures. K. SEILER (Naturwiss., 1939, **27**, 261).—In order to avoid the use of large quantities of liquid H_2 in reaching He temp. the H_2 can be liquefied where it is actually to be used. Apparatus by which this can be accomplished is described. It is suitable for the cooling of small masses to He temp. and for demonstrating superconductivity. A. J. M.

Electrically heated m.p. apparatus for corrected m.p. in a temperature range of 20—400°. G. KUBICZEK and A. SCHRECKER (Chem. Fabr., 1939, **12**, 54—55).—The apparatus consists of two concentric tubes (~50 cm. long) of the clearest Jena bomb-glass, with a coil of resistance wire wound on the inner tube fixed at the lower end in a small box which contains a variable resistance for mains current control. The temp. is const. from 5 cm. above the lowest turn to 2 cm. below the highest, and the thermometer with a capillary m.p. tube attached is suspended in this zone. I. C. R.

Thermopile for low-temperature radiation measurements. I. M. MORIYAMA (Rev. Sci. Instr., 1939, **10**, 164).—Constructional details of a simple thermopile of sensitivity approx. 1000 μv. per g.-cal. per sq. cm. per sec. are given. J. A. K.

Multiple-exposure X-ray spectrometer. A. R. UBBELOHDE (J. Sci. Instr., 1939, **16**, 156—161).—A multiple-exposure X-ray spectrometer which has been constructed for measuring small changes in lattice spacing of crystals is described. The instrument is suitable for both powder and single-crystal photographs, and the specimen can be investigated either in vac. or in any desired gas. Various experimental errors which arise in determining the position of an X-ray reflexion can be directly evaluated on the spectrometer itself. Its use in measuring isotope effects in crystals is illustrated by typical X-ray spectra comparing $CO(NH_2)_2$ with $CO(ND_2)_2$ and KH_2PO_4 with KD_2PO_4. D. F. R.

Device to regulate intensity of metallographic illumination. G. T. WILLIAMS (Met. Progr., 1939, **35**, 72).—Interposition of two mutually adjustable

Polaroid discs between the H_2O cell and the illuminator affords a means of regulating the intensity of illumination when examining micro-specimens.

R. B. C.

Photo-electronic photography. A. LALLEMAND (Compt. rend., 1939, **208**, 1211—1212; cf. A., 1937, I, 7).—An image of the light source is formed on an alkali-metal photo-cathode, and the photo-electrons, accelerated by an applied potential of 32—42 kv., register a reproduction of the image on a photographic plate or (less advantageously) are recorded by an electron counter. The device is much more sensitive than a photographic plate. A. J. E. W.

Jena dispersion filter. E. BERGER and A. KLEMM (Zeiss-Nachr., 1936, **2**, 49—55; Chem. Zentr., 1936, ii, 3448).—The filter, consisting of a sintered borosilicate glass plate immersed in a suitable liquid (e.g., a benzoic ester), is transparent to the λ for which the μ vals. for the two media are equal. This λ is varied (730—400 mμ.) by change of temp. (10—60°). The half-intensity band-width is 3—20 mμ. (400—640 mμ.). A. J. E. W.

Photo-electric colorimeter. R. HAVEMANN (Biochem. Z., 1939, **301**, 105—115).—Results obtained with the apparatus described are accurate to within 0·1% and are not affected by variations in the intensity of the light or in the sensitivity of the photo-electric cells. The standardisation curve showing the relationship between extinction coeff. and unit of measurement is, for the greater part of its course, a straight line. The fundamentals of direct and indirect photo-electric colorimetry are discussed. W. McC.

Simple photo-electric colorimeter. A. ZELLER (Ber. deut. bot. Ges., 1938, **56**, 392—396).—The construction of the apparatus is described.

A. G. P.

New type of "X-ray microscope." W. L. BRAGG (Nature, 1939, **143**, 678).—A method of converting the measurements of X-ray beams diffracted by a crystal into an optical image of the crystal structure is described. L. S. T.

Spark gap. J. ZIELINŚKI (Acta phys. polon., 1935, **4**, 135—138; Chem. Zentr., 1936, ii, 1765).—A spark-gap with Zn electrodes, suitable for the excitation of low-intensity fluorescence, is described.

A. J. E. W.

Properties of supermicroscopic images. B. VON BORRIES and E. RUSKA (Naturwiss., 1939, **27**, 281—287).—The production of the image in a super-(electron) microscope is discussed, with particular reference to the depth of sharpness, the contrast, and contour of the image. A. J. M.

Technique of super-microscope work. H. RUSKA (Naturwiss., 1939, **27**, 287—292).—The technique for successful work with the electron microscope is discussed. The method of making preps. for the electron microscope, particularly on films, is described. A. J. M.

Measurement of very small resistance variations by means of oscillatory circuits of unstable frequency. S. FAHRENTHOLZ (Z. tech. Physik, 1936, **17**, 187—190; Chem. Zentr., 1936, ii, 1581).—

A valve-oscillator device giving rapid indication of bolometer resistance variations is described.

A. J. E. W.

New type of polarograph with solid electrodes. R. J. WALEN and M. HAÏSSINSKY (J. Phys. Radium, 1939, [vii], **10**, 202—208).—An apparatus for registering potential–current curves during electrolysis with solid electrodes is described. The use of the apparatus is illustrated with reference to, inter alia, anodic oxidation of $H_2C_2O_4$, variation of the potential of deposition with the concn. of $CdSO_4$ and of $Pb(NO_3)_2$, and the anodic deposition of PbO_2. W. R. A.

Arrangement for measurements with the dropping mercury electrode (Heyrovský polarograph). R. VANOSSI (Bull. Soc. chim., 1939, [v], **6**, 817—823).—An improved arrangement of polarograph is described. An external Hg_2Cl_2 reference electrode is employed. J. W. S.

Micro-electrolytic determinations in small amounts of liquid. J. DONAU (Mikrochem., 1939, **27**, 14—20).—The solution is placed on a disc-shaped cathode and a Pt wire anode is allowed to dip into it. Both electrodes are fixed to a U-shaped ebonite holder, which, by rotation, permits the electrodes to be inclined and rinsed at the conclusion of the electrolysis without interrupting the passage of current. In a second procedure described, electrolysis is carried out in a tube provided with a tap, so as to permit rinsing of the electrodes without interrupting the passage of current. J. W. S.

Polarisation of quinhydrone electrodes. D. ILKOVIČ (Coll. Czech. Chem. Comm., 1939, **11**, 176—178; cf. Cupr., A., 1939, I, 202).—The discrepancy between observed and calc. results is due to incorrect application of the laws of diffusion rather than to the existence of local cells at the electrodes. D. F. R.

[Polarisation of quinhydrone electrodes.] (A) V. CUPR. (B) D. ILKOVIČ (Coll. Czech. Chem. Comm., 1939, **11**, 179—183, 184—186).—(A.) The equations in the original paper are modified but further support is given to the existence of local cells (see preceding abstract).

(B) Polemical. D. F. R.

Combined calomel and measuring electrodes. A. SALMINEN (Suomen Kem., 1939, **12**, A, 75—76; cf. A., 1939, I, 104).—Apparatus is described.

M. H. M. A.

Method of measuring electrical conductivity of solutions. V. D. POLJAKOV and A. V. IVANOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 1119—1140).—An apparatus for the measurement of resistance of solutions involves a Wheatstone bridge, a generator, and an amplifier, an a.c. with symmetrical wave being obtained by a tuning fork undamped generator. A method of obtaining sound oscillations by means of an electron tube, using only the a.c. source, is discussed. With fused salts the best results are obtained by using electrodes of invariable inter-electrode distance. F. H.

Gold–chromium resistance wire. T. B. GODFREY (J. Res. Nat. Bur. Stand., 1939, **22**, 565—571; cf. B., 1935, 232).—Coils of wire of Au–Cr alloy (2·1% Cr) differ considerably in their response to

heat-treatment, but, by baking at 170—200°, it is possible to make the temp. coeff. of resistance (α) as low as is desired for the temp. range 18—35°. Whereas heating a coil generally reduces α, mechanical working raises it, and can be used for correction if heat-treatment has been carried so far as to make α negative. For optimum stability, however, mechanical working and strain in mounting should be avoided. The pressure-coeff. of resistance for a Au–Cr coil is $1 \cdot 1 \times 10^{-6}$ per atm. The alloy is suitable for use in resistances for precision instruments.
J. W. S.

Ultra-violet dosimetry. Dosimetry of fast neutrons. Dosimetry for radium applicators. —See A., 1939, III, 717.

Background fog in cloud chambers. E. H. PLESSET and F. M. PLESSET (Rev. Sci. Instr., 1939, **10**, 166).—A persistent fog observed in a cloud chamber has been traced to the interaction of alcohols and the black velvet used as photographic background.
J. A. K.

Simple counting aid. C. GOODMAN and A. L. HERMAN (Rev. Sci. Instr., 1939, **10**, 164—165).— A hand-manipulated recording stylus facilitates the counting of photographically recorded impulses, e.g., in the valve electrometer method of measuring weak α-ray sources.
J. A. K.

Operation of spark counter. R. STUBER (Helv. Phys. Acta, 1939, **12**, 109—146).—With the counter described, the effects of the nature and material of the electrodes and the nature and pressure of the gas used on the sparking potential and the vol. in which counts are recorded have been studied with different ionising radiations.
L. J. J.

Phenomenon observed with the Rutherford–Geiger counter-tube under a relatively strong irradiation. B. KWAL (Compt. rend., 1939, **208**, 1082—1084).—By varying the potential applied to a Rutherford–Geiger counter-tube, and by interposing various thicknesses of Al foil between a Po source and the window of the tube, the counter can be made in turn sensitive to protons, α-particles, electrons, and γ-rays of Po.
W. R. A.

Recent developments in cyclotron technique. W. B. MANN (Nature, 1939, **143**, 583—585).
L. S. T.

Counter for large [gaseous] ions giving the mobility spectrum directly. P. QUENEY (Compt. rend., 1939, **208**, 1521—1523).—The apparatus described consists essentially of two successive cylindrical condensers through which the gas current is passed; the no. of ions between given mobility limits is given by the current obtained from a collector.
A. J. E. W.

Measurement of magnetic saturation intensities at different temperatures. W. SUCKSMITH (Proc. Roy. Soc., 1939, **A, 170**, 551—560).—A new method for measurements on a few cu. mm. of material is described. It consists of an arrangement for the determination of the force acting on a ferromagnetic specimen suspended in a non-uniform magnetic field. Numerical vals. are given for the saturation intensity in Fe and Ni at 20° and —190° in fields from 9000 to 18,000 gauss.
G. D. P.

Preservation of sodium rhodizonate indicator paper. A. L. GODBERT and R. BELCHER (Analyst, 1939, **64**, 346).—The papers may be kept in air for a day, or even longer, if dried in vac. over $CaCl_2$. If kept in vac. they remain effective for several days.
E. C. S.

Determination of internal volume of steel capillaries for measurement with gases. J. KAMINSKY and B. E. BLAISDELL (Rev. Sci. Instr., 1939, **10**, 151; cf. A., 1939, I, 225).—A correction.
J. A. K.

All-glass flow-meter with interchangeable orifices. ANON. (Chem. and Ind., 1939, 514—515). —The meter illustrated consists essentially of a detachable orifice to control the rate of flow of gas, and a liquid manometer to measure the pressure fall across the orifice. A wide range of flow rates is obtained by means of interchangeable orifices of different sizes.
L. S. T.

Gas circulation apparatus. J. MENGELIS (Z. physikal. Chem., 1939, **184**, 42—44).—An apparatus which will circulate 100—150 c.c. of gas per min. either by compression or suction, and can also be used as a suction pump, is described.
C. R. H.

Theory of the process of Clusius and Dickel for the separation of gas mixtures. W. VAN DER GRINTEN (Naturwiss., 1939, **27**, 317).—Theoretical (cf. A., 1938, I, 539).
A. J. M.

Specific gravity meter for flowing liquids. O. LANJOUW (Chem. Weekblad, 1939, **36**, 331—332).— A glass apparatus is described in which a const. head of the flowing liquid (e.g., NaOH lye) is balanced against a stationary column of an inert liquid of lower d (e.g., mineral oil) contained preferably in a graduated tube placed at a slope (1 : 10) in order to facilitate reading of the meniscus. Differences of $0 \cdot 01\%$ in the concn. of NaOH solutions can be measured satisfactorily.
S. C.

Safety device for differential oil manometer. W. BARKAS (J. Sci. Instr., 1939, **16**, 162).—The bottom of the U-tube is made of rather wider diameter tube than the rest and contains a steel ball bearing. Normally the ball remains in the centre of this tube and offers no hindrance to the manometer equilibrium, but any sudden large difference in pressure in the two limbs drives the ball hard up against the narrower portion of the tube and thus prevents the oil from blowing out.
D. F. R.

Determination of the surface tension of liquids by weighing of falling drops. C. SĂLCEANU and H. McCORMICK (Compt. rend., 1939, **208**, 1278—1280).—Constructional details of the apparatus are given. The diameter of the jet (5·0 mm.) is such that the drop-wt. (in mg.) $= \gamma$.
A. J. E. W.

Surface [film] pressure gauge with hanging suspension. J. GUASTALLA (Compt. rend., 1939, **208**, 973—975).—The tension of two threads retaining the surface film is communicated to either side of a suspended rectangular frame, the displacement of which measures the surface pressure. With optical

magnification of the displacement, pressures of $\not> 12$ dynes per cm. are measured with an accuracy of $\sim$0·01 dyne per cm. Film compression curves can be registered photographically.   A. J. E. W.

Glass and rubber laboratory pump. E. L. LAZIER (Science, 1939, **89**, 419—420).—The Palmer pump (A., 1934, 1195) has been modified to deal with 1500 c.c. per min. against a pressure >1 m., and to operate in any position.   L. S. T.

Efficiency of a rotary distillation column. B. J. MAIR and C. B. WILLINGHAM (J. Res. Nat. Bur. Stand., 1939, **22**, 519—527).—Measurements of the height equiv. to a theoretical plate (H.E.T.P.), hold-up, and through-put have been made on a distillation column with rotating members (Urey *et al.*, A., 1936, 1350) and with rectifying section 56 cm. long and 5 cm. diameter, using methyl*cyclo*hexane–n-C_7H_{16} test mixtures. The lowest H.E.T.P. (1·04 cm.) was obtained with conical rotating members, and its val. was const. for throughputs of 2—10 ml. of liquid per min. and speeds of rotation 250—1500 r.p.m.   J. W. S.

Fifty-cell laboratory distillation column. V. Z. DANEŠ (Chem. Listy, 1939, **33**, 153—156).—Apparatus designed for high-efficiency separation up to 150°, including an electric heater and pressure-operated thermo-control, is described.   A. R. W.

Cell for dust counting. K. L. DUNN (J. Ind. Hyg., 1939, **21**, 202—203).—In the counting cell, which is made of Pyrex glass, one of the two component parts has a ground surface which adheres to the optically flat surface of the other part, and so avoids the use of cements.   E. M. K.

Activity of dust as condensation nuclei. C. JUNGE (Meteorol. Z., 1936, **53**, 186—188; Chem. Zentr., 1936, ii, 1977).—Experiments with different types of dust and with paraffin and oil droplets show that particles of all types, irrespective of their chemical nature, are counted by a Scholz counter.   A. J. E. W.

[Apparatus for] analysis of combustion and mine gases etc.—See B., 1939, 567.

J. W. Gibbs. C. A. KRAUS (Science, 1939, **89**, 275—282).   L. S. T.

Geochemistry.

Distribution of ozone in the stratosphere. W. W. COBLENTZ and R. STAIR (J. Res. Nat. Bur. Stand., 1939, **22**, 573—606).—The spectral quality and total intensity of ultra-violet solar radiation have been measured at a ground station and at various elevations above the earth's surface, and the quantity of O_3 above the points of observation is deduced. Most of the O_3 is localised in a layer at an elevation of 18—27 km., with a max. at $\sim$25 km. The intensity of short-λ ultra-violet radiation at 27 km. is $\sim$10 times that of direct sunlight at sea level. Changes in $[O_3]$ following changes in barometric pressure are discussed.   J. W. S.

Influence of solar radiation on the mean temperature of atmospheric ozone. (MME.) A. VASSY and E. VASSY (Compt. rend., 1939, **208**, 1518—1520). —The low temp. vals. given by Barbier and Chalonge (A., 1939, I, 238) are questioned, and the superiority of Bouguer's method of measurement is claimed. No consistent difference has been detected in the diurnal and nocturnal O_3 temp., but the above authors' results for polar regions show an increase in the mean temp. with increasing duration of daylight.   A. J. E. W.

Atmospheric ozone. E. VASSY (J. Phys. Radium, 1939, [vii], **10**, 250).—Polemical against Barbier and Chalonge (A., 1939, I, 238).   W. R. A.

Iodine–air investigations. H. JESSER and E. THOMAE (Z. anal. Chem., 1939, **116**, 305—309; cf. A., 1937, I, 636).—I contents of air at Stuttgart for 1937—1938 are recorded and correlated with the meteorological conditions.   L. S. T.

Curves of colorimetric titration of sea-water. S. PRÁT and R. ŘETOVSKÝ (Bull. Soc. Chim. biol., 1939, **21**, 583—595).—Titrimetric curves of sea-H_2O from a depth of 15 m. off Yugoslavia have been obtained with the aid of the universal indicator of

Cuta and Kamen (A., 1936, 950). Sea-H_2O contains two buffer systems, one of which comes into operation only when physicochemical or biological factors cause a change in equilibrium. This " latent " buffer is due to excess of bases. The buffering capacity of sea-H_2O increases on both sides of the normal p_H (8·2 to 8·3) and probably increases with depth. The p_H of sea-H_2O changes on keeping; if air is excluded, for p_H vals. <8 the p_H slowly increases whilst at vals. >8 it very slowly decreases. If air is then admitted the former vals. still increase whilst the latter show a definite decrease. CO_2 plays a very important part in the equilibrium of the buffers in sea-H_2O. Artificial sea-H_2O possesses a greater p_H val. than normal sea-H_2O. When freshly prepared it has p_H 7·6 but in contact with air it becomes more alkaline. The buffer system of the H_2O in the cavity of *Codium bursa*, L., and of the juice of *Valonia utricularis*, Roth, has been examined.   J. N. A.

Annual cycles of salt lakes which have salt deposits. B. I. STEPANOV and V. I. NIKOLAEV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 1255—1264).—The lake-surface brines of Basinsky lakes become richer in $MgSO_4$ in spring, in $MgCl_2$ in summer, and in NaCl in winter. In Dec., Jan., and Feb., $Na_2SO_4,10H_2O$ and NaCl crystallise out together from the lakes at $\sim$ −3°.   F. H.

[Salinity of] Raselm lakes. V. GRIMALSCHI and V. HOHOR (Bull. Acad. Sci. Roumaine, 1939, **21**, 12—19).—The stratification of the lake H_2O has been studied by measurements of [NaCl], [Ca], and [NO_3'], and correlated with seasonal variations in the influx of fresh and salt H_2O from the Danube and Black Sea, respectively, and with weather conditions. L. J. J.

Accumulation of nutrient salts in mud water of fresh-water basins. S. W. BRUEVICZ, R. M.

PEVZNIAK, V. L. PONIZOVSKAJA, and M. A. SIBIRJAKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 282—286).—Seasonal changes in salinity, NH_3, NO_2', NO_3', org. N and P, PO_4''', Si, and Fe contents of H_2O and muds at various depths are recorded and discussed.   A. G. P.

Chemical and physico-chemical analysis of the Roman hot-springs at Monfalcone. B. DORO (Annali Chim. Appl., 1939, **29**, 91—111).—Data for the H_2O (temp. ~38°) are tabulated.   F. O. H.

Huckitta meteorite, Central Australia. C. T. MADIGAN [chemical analyses by A. R. ALDERMAN] (Min. Mag., 1939, **25**, 353—371).—A pallasite weighing 1415 kg. with much weathered iron-shale was found in 1937 near Huckitta station, 135 miles N.E. of Alice Springs. Polished surfaces show broken crystals of olivine (40·1%) in a matrix of metal with small amounts of troilite and schreibersite. Analysis of the olivine gave SiO_2 40·21, FeO 12·57, MgO 47·49, CaO 0·20 = 100·47; and of the metallic portion Fe 89·36, Ni 8·98, Co 0·45, S 0·02, P trace, C 0·13, insol. 0·47 = 99·41%. The " Alice Springs " pallasite described in 1932 was no doubt a transported fragment from this mass.   L. J. S.

Volcanism and nuclear chemistry. J. NOETZLIN (Compt. rend., 1939, **208**, 1100—1102).—Nuclear reactions are considered as the fundamental mechanism of the life of stars. On the earth, volcanic eruptions are possibly the results of nuclear reactions in the depths of the earth's crust, the agent probably being the neutron.   W. R. A.

Molecular structure and compressibility of matter in the interior of the earth, and possible causes of the permanent magnetism of the earth. H. HAALCK (Forsch. u. Fortschritte, 1939, **15**, 173—175).—Assuming that at the temp. and pressure of the interior of the earth all matter is almost completely ionised and the formation of mols. is no longer possible, the compressibility of the material of the interior of the earth (the kernel, 7000 km. diameter) is calc. The electric field strength in this region can be calc. and, taking into account the earth's rotation, it is possible to explain the existence of terrestrial magnetism. The causes of local and regional anomalies, and the secular variation of the earth's magnetic field, are discussed.   A. J. M.

History of the study of ore minerals. E. THOMSON (Amer. Min., 1939, **24**, 137—154).—Various methods of investigating ore minerals are briefly reviewed. A bibliography is given.   L. S. T.

Beryl from Beam mine, Cornwall. A. F. HALLIMOND (Min. Mag., 1939, **25**, 351—352).—Beryl, as white crystals previously mistaken for quartz, is recorded from this mine near St. Austell. It is associated with cassiterite and tourmaline on granite.   L. J. S.

Adinoles of Dinas Head, Cornwall. S. O. AGRELL (Min. Mag., 1939, **25**, 305—337).—These rocks are composed essentially of albite and quartz with some tourmaline, carbonates, etc., and in chemical composition they resemble quartz-kerato-phyre. They have, however, been produced by the metasomatic action of solutions rich in soda on slates, these solutions being derived from albite-dolerite which was intruded into the slates. Several chemical analyses are given of the various rocks.   L. J. S.

Potassium magnesium ferric sulphate resembling voltaite ; β-metavoltin. B. GOSSNER (Zentr. Min., A, 1936, 262—269; Chem. Zentr., 1936, ii, 3894).—The voltaites and metavoltin occur in two apparently similar cryst. forms, one having high symmetry and the other an aggregated structure. Metavoltin is dimorphous; the α- and β-forms are hexagonal and pseudo-hexagonal, respectively, the latter exhibiting a variety of twin formations. Cubic ferro-voltaites occur, but voltaites are generally found as overgrowths on optically anisotropic crystals. A K Mg voltaite (composition variable, e.g., SO_3 51·74, Fe_2O_3 14·69, Al_2O_3 3·37, MgO 8·87, K_2O 7·22, H_2O 14·05%) has been prepared; its composition corresponds with the limiting formula $M^IM^{II}Fe^{III}(SO_4)_3,4H_2O$ only if extensive replacement of Mg and K by Fe is assumed.   A. J. E. W.

Lawsonite from Cuba. H. M. E. SCHÜRMANN (Zentr. Min., A, 1936, 245—251; Chem. Zentr., 1936, ii, 3893).—The lawsonite, which occurs in inclusions of chlorite slate in serpentine, has hardness 6, n 1·666—1·68, and d 3·056±0·003. Analysis : SiO_2 37·80, TiO_2 0·68, Al_2O_3 32·56, Fe_2O_3 0·05, FeO 0·34, MgO 0·32, CaO 16·10, Na_2O 0·51, K_2O 0·24, H_2O+ 11·26, H_2O- 0·04, F 0·02%, MnO, a trace.   A. J. E. W.

Varieties of jasper from the Tokaj-Hegyalja mountains. E. LENGYEL (Föld. Közlöny, 1936, **66**, 129—147; Chem. Zentr., 1936, ii, 3893).—The nature and occurrence of the deposits are described.   A. J. E. W.

Brickerite. (A, B) F. AHLFELD and R. MOSEBACH (Zentr. Min., A, 1936, 226—231, 287; Chem. Zentr., 1936, ii, 3893).—(A) Brickerite ($4ZnO,3CaO,2As_2O_5$) has a fibrous structure, and is of thermal origin; hardness 4, d 4·13. The crystals are probably triclinic, and are optically biaxial (positive); α 1·752, β 1·7555, γ 1·779; $2Vn_\gamma = 41°$.
(B) Brickerite is identical with austenite, a new analysis giving the composition $2CaO,2ZnO,As_2O_5,H_2O$.   A. J. E. W.

Bertrandite from Klein-Spitzkopje, South West Africa. P. RAMDOHR (Zentr. Min., A, 1936, 257—262; Chem. Zentr., 1936, ii, 3893).—Deposits of bertrandite, $Be_4Si_2O_7(OH)_2$, a hydrothermal secondary phase of a pegmatite, are described.   A. J. E. W.

Lattice constants of cerussite. G. A. LINDSAY and H. C. HOYT (Z. Krist., 1938, **100**, 360—362; cf. Colby, A., 1933, 215).—A precision X-ray determination, by the Bragg method, of natural face spacings of a specimen from Tsumeb gives the cell elements : a 5·1726, b 8·4800, c 6·1302 A.   I. McA.

Metamorphism of a granitic dyke at Franklin, New Jersey. C. MILTON (J. Geol., 1939, **47**, 161—175).—The rock, hitherto regarded as of sedimentary origin, is considered to be an altered pegmatite dyke. Two chemical analyses are given.   L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

AUGUST, 1939.

Stark effect of Balmer lines after passage of the atoms through a very strong electric field. R. RITSCHL (Physikal. Z., 1939, **40**, 413—415).—If H positive rays traverse a transverse electric field sufficiently strong to remove the red Stark-effect components by ionisation, only violet-displaced components are observed when the longitudinal field is decreased. If, after passage through the ionising field, the direction of the field is reversed in a second field condenser, only the violet-displaced components are again observed in the second field space. If the positive rays pass through a space without field, after passing through the strong ionising field, the atoms emit only violet-displaced components when the field is again increased. A. J. M.

Comparative measurements on the Stark effect of deuterium and hydrogen. W. STEUBING, A. KEIL, and F. STOLPE (Z. Physik, 1939, **112**, 560—568).—Determinations of the separations for H and D, using high dispersion, fail to reveal the predicted difference. Both H and D show the expected asymmetry of the photographed image, due to the fine structure splitting of the Balmer levels. Differences in the intensity ratios of the single components are confirmed. Under identical conditions of examination the D components are less sharp than the H. L. G. G.

Variation in intensities of spectral lines with direction of observation of the Stark effect. H. KUBOTA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 7—11).—A theoretical expression has been obtained for the relative intensities when viewed at an arbitrary angle and compared with the experimental results given by a Lo Surdo tube having a rotating axis. The agreement is satisfactory. [Y. ISHIDA.] The Δm selection rule for the transverse effect cannot hold if the condensing lens has a large aperture and so collects beams which are not parallel to the optic axis. T. H. G.

Absorption spectrum of oxygen. L. HERMAN (Ann. Physique, 1939, [xi], **11**, 548—611).—A column of 100 m. of gas was employed and the very feeble absorption in the visible and ultra-violet regions has been studied. Spectra due to O_2, O_3, and O_4 are discussed. W. R. A.

Stark effect of the Ne II spectrum. Y. ISHIDA, T. TAMARU, and G. KAMIJIMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 12—30).—Measurements have been made using the Be cathode in a Lo Surdo quartz tube and many lines due to the $3d$–nx transitions have been recorded. Their Stark effects resemble that of He. Normal coupling seems to be observed by the lower configurations but as n increases jj-coupling appears to obtain. The abs. term vals. have been calc. T. H. G.

Limiting continuum of the principal series of sodium. J. BOTT (Ann. Physik, 1939, [v], **35**, 314—328).—At. absorption coeffs. of Na in the limiting continuum of the principal series have been measured and agree with theory (cf. Trumpy, A., 1931, 1203). The photoionisation of Na cannot be measured by the space-charge method using a Na–W cathode, owing to the small electron emission of the cathode (cf. Bott, *infra*). O. D. S.

Effect of foreign gases on the continuous absorption spectrum of bromine. N. S. BAYLISS and A. L. G. REES (Trans. Faraday Soc., 1939, **35**, 792—800).—A full description of work already reported (A., 1939, I, 289). F. L. U.

Constitution of the hot-cathode discharge in the neighbourhood of hollow hot cathodes. E. F. RICHTER (Z. tech. Phys., 1936, **17**, 306—315; Chem. Zentr., 1936, ii, 3987).—Results of Langmuir probe tests are described and discussed. The potential distribution corresponds with that found by Compton and Eckart for a low-voltage arc with a filament cathode. The variation of potential, electron temp., and current distribution with various factors is also studied. A. J. E. W

Energy transfer by elementary collision processes. H. SCHÜLER and H. HABER (Z. Physik, 1939, **112**, 614—625; cf. A., 1939, I, 177).—A discussion of collision processes in the discharge in gases, *e.g.*, BiH. L. G. G.

Isotope shift of spectral lines. I. E. TAMM (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 764).—The magnitude of short-range interaction between electrons and neutrons required to account for isotope shifts of spectral lines is of the same order as that already suggested by the author. L. J. J.

Effect of positive ions on an electron current limited by space charge. J. BOTT (Ann. Physik, 1939, [v], **35**, 329—332).—Theoretical. The effect of positive ions on the electron space charge at a plane electrode is calc. Kienzle's results (cf. A., 1937, I, 592) can be explained by the space-charge effect of the positive ions on the potential distribution before the cathode. O. D. S.

Observation of radiations of low intensity in the neighbourhood of a bright spectrum line. A. COUDER and P. JACQUINOT (Compt. rend., 1939, **208**, 1639—1641).—The obscuring of a weak satellite

by diffracted light from a more intense line is considered. The use of a slit only slightly longer than its width, and of a square diaphragm diagonal to the axis of dispersion, is advantageous. A. J. E. W.

Measurement of the natural width of X-ray lines. G. ORTNER and R. ZENTNER (Sitzungsber. Akad. Wiss. Wien, IIa, 1935, **144**, 437—453; Chem. Zentr., 1936, ii, 3878).—The half-val. widths (w) of the K-lines of Fe, Ni (first-order), Cu, and Co (first- and second-order) have been measured with a single (calcite) crystal spectrometer. w falls with increasing Z, as found by Allison (A., 1933, 881). The second-order w vals. are very small (Cu-$K\alpha_1$, 0·52 A.). The calculation of the true natural width of the lines is discussed. A. J. E. W.

Auger effect and L emission lines. A. HAUTOT and H. SAUVENIER (Compt. rend., 1939, **208**, 1565—1566).—The apparent broadening of the $L_{II, III}$ emission lines of Na, Mg, and Al may be due to the occurrence of the Auger effect at the instant of radiation. The probability of the effect for the L_I band of Na is high, and the L_I line may be very broad and of low intensity. The $L_{II, III}$ band of Al is abnormally broad, and non-parabolic. A. J. E. W.

Discharge voltage variations in molecular gases due to irradiation. W. FUCHS and G. SCHUMACHER (Z. Physik, 1939, **112**, 605—613).—The relation between discharge potential and current due to irradiation of the cathode with ultra-violet light is examined. L. G. G.

Electron interferences at light molecules by the sector method. P. P. DEBYE (Physikal. Z., 1939, **40**, 404—406).—The sector process (A., 1939, I, 130) has been improved, and photographs obtained with CCl_4, CS_2, C_2H_2, and NH_3 are reproduced and discussed. A. J. M.

Back-diffusion of fast electrons in narrow channels. Production of sharp luminous spots in X-ray tubes. F. OSWALD (Z. tech. Phys., 1936, **17**, 41—44; Chem. Zentr., 1936, ii, 933).—Difficulties due to spurious excitation by reflected electrons are discussed. A tube-form hollow cathode giving a sharp spot is described. A. J. E. W.

Normal and abnormal δ-rays. D. SKOBELTZYN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 759—760).—Two distinct types of secondary electrons are produced in N_2 by β-rays of energy 1—3 e.Mv. The properties of normal δ-rays agree with an elastic collision mechanism, with a probability of formation in accordance with Møller's formula, indicating normal electronic diffusion. L. J. J.

Spatial distribution of ionic clouds produced by photo-absorption and scattering absorption in the ionisation of air by X-rays. I. H. KÜSTNER (Ann. Physik, 1939, [v], **35**, 153—192).—The total ionisation produced by X-rays of varying hardness in air has been analysed into components produced by Compton electrons and photo-electrons, by differentiation of ionisation–radius curves for axially-irradiated cylindrical chambers. L. J. J.

Measurements of the electrical excitation functions of mercury. P. VETTERLEIN (Ann. Physik, 1939, [v], **35**, 251—271).—The velocity distribution of electrons produced by inelastic collisions has been measured by a method which is described, and excitation functions of Hg between 100 and 380 v. are given. W. R. A.

Effects produced by bombarding a metallic surface with fast electrons. J. TRILLAT and R. MERIGOUX (J. Phys. Radium, 1939, [vii], **10**, 245—249).—On allowing fast electrons (20—60 kv.) to impinge on a metal surface the point of impact can be detected visually. Further, this point is now passive to chemical reagents and does not exhibit the characteristic diffraction patterns of the metal. This effect is interpreted as arising from the deposition of C produced from vapours of hydrocarbons always present in the greased joints of the apparatus. W. R. A.

Inner motion of the electron. I. H. HÖNL and A. PAPAPETROU (Z. Physik, 1939, **112**, 512—540).—Theoretical. L. G. G.

Radiative corrections for electron scattering. S. M. DANCOFF (Physical Rev., 1939, [ii], **55**, 959—963).—Mathematical. A relativistic treatment. N. M. B.

Secondary electron emission. H. NELSON (Physical Rev., 1939, [ii], **55**, 985).—Since available data indicate that the high secondary-to-primary ratios δ for electropositive metals are characteristic of contaminated rather than clean surfaces, it is suggested that the existence of a positive charge in surface films may influence the secondary-electron emission characteristics. An experimental curve of δ as a function of primary electron velocity for a film of MgO on nichrome shows a marked inflexion in the region of low potentials corresponding with a transformation from negative to positive charge in the insulating film. N. M. B.

Secondary electron emission due to H_2^+ and D_2^+ ions. (Miss) M. HEALEA (Physical Rev., 1939, [ii], **55**, 984; cf. A., 1936, 1041).—For ions of energies 300—1500 ev. emissions due to bombardment of a hot Ni target varied approx. linearly 13·1—44·7% for H_2^+ and 12·2—35·7% for D_2^+ over the energy range. Emission curves are given and discussed. N. M. B.

Absorption of high-energy electrons. K. D. SINELNIKOV, A. K. WALTHER, A. J. TARANOV, A. V. IVANOV, and U. S. GUMENIUK (Bull. Acad. Sci. U.R.S.S., 1938, Sér, Phys. 747—755).—Ranges of electrons of energy 0·4—2·3 e.Mv. in Li, C, Al, Cu, and Pb have been measured, and sp. rates of energy loss determined. These agree with Bloch's formula for Li and C, but heavier atoms give losses > the theoretical vals. (2—3 times greater for Pb). The discrepancy $\propto Z^2$, and is independent of the initial energy. L. J. J.

Energy losses of fast electrons. L. A. ARTZIMOVITSCH and V. A. CHRAMOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 757—759).—Results in agreement with theory have been obtained for energy losses of electrons of energy 1—2·65 e.Mv. in C, Al, Cu, and Pb,

by the use of a double focussing magnetic monochromator.   L. J. J.

Conditions for producing intense ionic beams. L. P. SMITH and G. W. SCOTT, jun. (Physical Rev., 1939, [ii], 55, 946—953).—Mathematical. Conditions for optimum production of positive ions and their complete removal from the ionisation region to form a beam are developed. Account is taken of the variation in ionisation cross-section as a function of electron energy. The mechanism of proton production is considered and the efficiency of arc type sources is discussed.   N. M. B.

Focussed beam source of hydrogen and helium ions. G. W. SCOTT, jun. (Physical Rev., 1939, [ii], 55, 954—959).—Based on the analysis previously reported (cf. preceding abstract), an ion source of high intensity in which the ions are produced by bombarding a region of gas by a focussed beam of electrons is described. An expression for the emission from the ring-shaped cathode used is given, and the emission–voltage curve calc. from this expression is compared with experiment. Curves of total ion yield plotted against electron emission, electron energy, and pressure, and a mass spectrographic analysis of H and He ion beams, are given. Electron beams of 2·2 amp. per sq. cm. and H ion beams of 4 ma. are reported. Proton yields are 5—80% of the total H ion beam. The He^{++} yield in the He ion beam is $\sim$5% of the total beam current.   N. M. B.

Detection of single positive ions, electrons, and photons by a secondary electron multiplier. J. S. ALLEN (Physical Rev., 1939, [ii], 55, 966—971).— A tube having 12 electrodes covered with a thin layer of Be, and, with 330 v. per stage, multiplying the primary current by a factor 10^5, is described. Ions of energies 50—20,000 ev. and masses 1—32 were detected. By increasing the gain of the thermionic amplifier electrons could be counted, and, with still more gain, single photons. As the pressure in the counter is 10^{-6} mm., it can be connected directly to the vac. system through which the electrons or ions are accelerated.   N. M. B.

Chemical studies by means of molecular beams. VIII. Method of measuring the intensity of potassium atomic beams with an incandescent tungsten surface. K. KODERA (Bull. Chem. Soc. Japan, 1939, 14, 141—147).—The difference between the efficiency of ionisation obtained by flashing K atoms deposited on a W surface and that calc. disappears if the correct vals. of the work function and of the contact potential of the W surface are used. Migration of adsorbed K atoms on the surface of W ribbon heated to 500—700° enables a high surface concn. to be reduced and produces better or even complete ionisation. A simple method for measuring the activation energy of surface migration is proposed.   W. R. A.

(A) **Scattering of protons by protons.** R. G. HERB, D. W. KERST, D. B. PARKINSON, and G. J. PLAIN. (B) **Analysis of experiments.** G. BREIT, H. M. THAXTON, and L. EISENBUD (Physical Rev., 1939, [ii], 55, 998—1017, 1018—1064).—(A) Available

scattering cross-section data for angles 15—45° (cf. Tuve et al., A., 1937, I, 5) are extended to energies 860—2392 ke.v. and results are compared with Mott vals. The ratio of the two sets of vals. rises with increasing angle and proton energy. At 1830 ke.v. measurements were made at scattering angles up to 60° and the scattering showed the theoretically expected asymmetry about 45°. As a check on the proton–proton measurements the scattering of protons from A and Kr with protons of energies 850—2440 ke.v. was investigated.

(B) A comprehensive analysis and discussion of available data.   N. M. B.

Approximate equality of the proton–proton and proton–neutron interactions for the meson potential. G. BREIT, L. E. HOISINGTON, S. S. SHARE, and H. M. THAXTON (Physical Rev., 1939, [ii], 55, 1103).—New data on scattering cross-section (cf. Simon, A., 1939, I, 293) and new proton–proton scattering experiments (cf. preceding abstract) indicate a still closer equality of the two interactions, and that this equality becomes almost perfect for the meson type of potential.   N. M. B.

Ionisation by collisions of positive ions. J. S. TOWNSEND (Phil. Mag., 1939, [vii], 28, 111—117). —A theoretical discussion.   T. H. G.

At. wt. of chlorine arising from industrial residues. P. DUTOIT and K. V. YACOUBYAN (Helv. Chim. Acta, 1939, 22, 805—808).—The at. wt. of Cl from old NaCl and $KClO_3$ electrolytic baths is indistinguishable from that of ordinary Cl. Residual Cl_2 from a Cl_2-distillation plant appears to have an at. wt. 0·007% > that of normal Cl, but this difference is at the limit of experimental error. A method of determining the at. wt. of Cl by potentiometric titation with $AgNO_3$ is described.   J. W. S.

At. wt. of iron. O. HÖNIGSCHMID and S. C. LIANG (Z. anorg. Chem., 1939, 241, 361—371).—From the ratios $FeBr_2 : 2Ag : 2AgBr$ the most probable val. is 55·850. Reasons are given for preferring this to the International val., 55·84.   F. J. G.

Isotope separation by thermal diffusion. W. H. FURRY, R. C. JONES, and L. ONSAGER (Physical Rev., 1939, [ii], 55, 1083—1095).—Mathematical. The theory of the process in an apparatus with two concentric tubes is developed. The equations for the convection and diffusion processes lead to an expression for the net transport of a single isotope, valid for arbitrary macroscopic properties of the gas. The transport equation is applied to separation factor and speed of operation for discontinuous running, and also for continuous flow of gas through the tube. The advantages of the two methods are compared and the concn. of ^{13}C by the use of CH_4 is considered.   N. M. B.

Activity of mesothorium free from radium. (MME.) S. COTELLE and L. WINAND (J. Chim. phys., 1939, 36, 73—77).—The γ-radiation and heat evolution were measured over a period of 60 days. Analysis of the curves is in agreement with theory.   F. L. U.

Stopping power of mica for α-particles of small range. W. RIEZLER (Ann. Physik, 1939, [v], 35,

350—353; cf. Bennett, A., 1936, 1172).—The air equiv. of mica and the energy loss in mica for Po α-particles of range 4—25 mm. have been measured. The air equiv. decreases by 12% with decreasing α-particle range. O. D. S.

Ionisation and range of α-particles in sulphur hexafluoride. W. RIEZLER (Ann. Physik, 1939, [v], **35**, 354—358).—SF_6 is a suitable gas for filling small ionisation chambers. The relative stopping power for Po α-particles is 3.91 ± 0.06, and the mean ionisation for 3-Me.v. α-particles is 1.08 (air 1.00). The stopping power and ionisation are not strictly proportional. O. D. S.

Total and specific ionisation of Po alpha-particles and their statistical fluctuations. J. M. W. MILATZ and G. A. W. RUTGERS (Physica, 1939, **6**, 529—550).—Measurements of the ionisation produced by α-particles from Po were made in a shallow and in a deep chamber with varying distances from source to chamber. A method of allowing for the scattering of the ranges and amounts of ionisation produced by individual particles is described; it permits the mean ionisation curve of a particle of a given range to be determined. This is independent of the range for the last few cm. of the path. The ionisation per unit length of path is ∝ the loss of energy of the particle. L. J. J.

Interpretation of β-disintegration data. A. I. ALICHANIAN and V. BERESTEZKY (Physical Rev., 1939, [ii], **55**, 978).—A discussion of the difficulties arising from Bethe's method (cf. A., 1939, I, 231) of interpreting β-disintegration data on the basis of Fermi's theory. N. M. B.

Absorption method for determining the range of recoil atoms. E. E. WIDDOWSON and S. J. GREGG (Nature, 1939, **143**, 760—761).—Methods for determining the absorption curves and recoil ranges of atoms resulting from α-particle disintegrations which immediately precede a β-particle disintegration are described. Built-up films of Ba stearate on stainless steel are used to provide absorbent screens of suitable thinness. L. S. T.

γ-Ray ion currents in air at high pressures and high gradients at high and low temperatures. J. W. BROXON and G. T. MERIDETH (Physical Rev., 1939, [ii], **55**, 883—893).—Investigations previously reported (cf. A., 1938, I, 426) were extended to temp. —76° and 96° at pressures up to 193 atm., and full data are plotted and discussed. Observed temp. coeffs. of the currents agree well in dependence on temp. and gas density with the predictions of the initial recombination theory and of the columnar theory at low collecting field intensities, and depend on field intensity as required by the columnar theory. The coeff. in Zanstra's equation (based on the Jaffé columnar theory) is modified to correspond with the new temp. N. M. B.

Interaction of fast neutrons with protons. E. O. SALANT, R. B. ROBERTS, and P. WANG (Physical Rev., 1939, [ii], **55**, 984—985).—The neutron–C and neutron–proton cross-sections measured for neutrons of ~15 Me.v. energy were 1.13×10^{-24} and 0.61×10^{-24} sq. cm., respectively. The theoretical neutron–

proton cross-section, evaluated from the phase shifts, agreed exactly with experiment. N. M. B.

Neutron measurements with boron trifluoride counters. S. A. KORFF and W. E. DANFORTH Physical Rev., 1939, [ii], **55**, 980).—Cu cylinders in glass envelopes with a central W wire and filled with BF_3 at 2—20 cm. pressure are used as counters and their characteristics are described. A slow neutron produces an α-particle by disintegration of the B nucleus and the α-particle produces a large amount of ionisation in the counter, as compared with that due to cosmic rays or γ-ray secondaries. By setting to record only the larger pulses, the α-particles are counted to the exclusion of β- or γ-counts. N. M. B.

Excess of neutrons from a Ra-α + Be source surrounded by beryllium. Z. OLLANO (Nuovo Cim., 1938, **15**, 604—608).—With a source surrounded by Be there are formed, in addition to the neutrons from the source and the photo-neutrons produced by the γ-rays, high-energy neutrons which are probably due to the process : $^9Be + n = {}^8Be + n + n$. O. J. W.

Neutron spectrum of Po + Be. G. BERNARDINI and D. BOCCIARELLI (Ric. sci. Progr. tecn., 1936, [ii], **7**, II, 89—92; Chem. Zentr., 1936, ii, 4088; cf. A., 1937, I, 161).—Neutron groups with max. energies of 4.2, 7.7, and 6.5 (?) Me.v. are observed. It is assumed that the effective cross-section of a neutron for collision with a proton is inversely ∝ its velocity. A scheme of energy levels, including the neutron group (11 Me.v.) corresponding with the ground state of $^{12}_6C$, is given. A. J. E. W.

Movement of neutrons in substances containing hydrogen. E. FERMI (Ric. sci. Progr. tecn., 1936, [ii], **7**, II, 13–52; Chem. Zentr., 1936, ii, 4087—4088).—A theoretical discussion of various collision and diffusion phenomena and of the production of thermal neutrons, based on a quantum-mechanical analysis of elastic and inelastic collisions between neutrons and protons or H atoms. A. J. E. W.

Transmission of slow neutrons through crystals. M. D. WHITAKER and H. G. BEYER (Physical Rev., 1939, [ii], **55**, 1101).—A comparison of measurements of cross-sections for slow neutron transmission through polycryst. and single-crystal Fe, Ni, SiO_2, and permalloy shows that the materials are much more transparent when in the form of single crystals. The bearing of this on the non-additive property of the cross-sections of constituent elements of compounds is discussed. N. M. B.

Forward scattering of neutrons by paramagnetic media. J. H. VAN VLECK (Physical Rev., 1939, [ii], **55**, 924—930).—Mathematical. Exchange forces are investigated. It is shown that the exchange interaction between the paramagnetic ions tends to make the scattering inelastic, and reduces the form factor for forward scattering so that it is no longer unity. A calculation of this reduction is attempted, and the distribution of energy changes in the inelastic process is estimated. Results indicate that in MnS, a typical material with appreciable exchange coupling, the form factor reduces the scattering of monochromatic liquid-air and room-

temp. neutrons near the forward direction by ~ 75 and 50%, respectively. N. M. B.

Magnetic scattering of neutrons. O. HALPERN and M. H. JOHNSON (Physical Rev., 1939, [ii], 55, 898—923).—Mathematical. A comprehensive development of previous considerations (cf. A., 1937, I, 438, 489) and suggestions for a series of experiments based thereon. N. M. B.

Volcanic phenomena and nuclear chemistry. J. NOETZLIN (Compt. rend., 1939, 208, 1662—1664; cf. A., 1939, I, 392).—A development of a theory of the production of volcanic eruptions by the energy of chain disintegration reactions induced by neutrons. A. J. E. W.

Formation of helium of mass 3 in an excited state. T. W. BONNER (Nature, 1939, 143, 681).—Cloud chamber experiments with the D–D reaction in He or CH_4 show that a high-energy and a low-energy group of neutrons arise from the reaction $D + D \rightarrow {}^3He + {}^1n$. The ^3He nucleus is left in an excited state at 1·84 e.Mv. in $\sim$15% of the disintegrations. The low-energy group is not produced by scattered neutrons; a low-energy neutron may be emitted when ^3He in an excited state is formed. L. S. T.

Threshold value of the photo-electric disintegration of beryllium. K. D. SINELNIKOV, A. K. WALTHER, V. S. GUMENIUK, and A. V. IVANOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 781—784).—The nuclear photo-electric effect in ^9Be irradiated with hard X-rays shows a threshold val. of $1·760 \pm 0·015$ e.Mv. The cross-section of ^9Be for any disintegration by electrons of energy up to 2·3 e.Mv. is shown to be smaller by several orders of magnitude than that for photons of the same energy. L. J. J.

The "slow" Wilson chamber. H. MAIER-LEIBNITZ (Z. Physik, 1939, 112, 569—586).—A chamber employing a liquid piston for expansion purposes, which is used in conjunction with a ciné-camera for photographing tracks, is described. No electrons are produced by reaction of neutrons with matter. The γ-spectrum of ^7Be shows a single line at 425 e.kv., the decay of ^7Be being due to electron capture with production of an excited ^7Li. After 35 min. behind Pb, 5 mesotrons of mass about 100 × electronic appeared in the chamber. Conditions for production of mesotrons are discussed. L. G. G.

Distribution of nuclear levels. I. I. GUREVITSCH and G. R. RIK (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 771—780).—The excitation curve for the (α,n) process in ^9Be with α-particle energies $\leqslant 8·8$ e.Mv. shows resonance max. at 3·7, 7·7, and 8·6 e.Mv., the two latter lying above the potential barrier of ^9Be, indicating intermediate formation of ^{13}C, which has levels at 13·1, 15·8, and 16·5 e.Mv., farther apart than is predicted by statistical theory. The mean intervals between levels for the resonance capture of slow neutrons are calc. as $\sim$15 e.v, 3 e.v., and 8—10 e.v. for groups of elements of mean at. wt. 110, 160, and 195, respectively; the rare-earth region shows a max. density of such levels. L. J. J.

Difference in Coulomb energy of light isobaric nuclei. J. G. FOX, E. C. CREUTZ, M. G. WHITE, and L. A. DELSASSO (Physical Rev., 1939, [ii], 55, 1106).—By determining the upper limit of the positron spectrum the difference in binding energy may be directly measured for two isobars of the type containing an excess of one proton or one neutron, and these can be formed by the endothermic (p,n) reaction. Investigations in the range ^{19}Ne—^{23}Mg, and anomalies beyond this point, are briefly reported with special reference to $^{19}F(p,n){}^{19}Ne$, $^{23}Na(p,n){}^{23}Mg$, and $^{21}Ne(p,n){}^{21}Na$. N. M. B.

Concentration of radiophosphorus ${}^{32}_{15}P$ by an electric field. J. GOVAERTS (J. Chim. phys., 1939, 36, 130—139).—A detailed account of work already noted (A., 1938, I, 339, 427). W. R. A.

Emission of γ-rays from fluorine under proton bombardment. P. I. DEE, S. C. CURRAN, and J. E. STROTHERS (Nature, 1939, 143, 759—760).—The resonance features of the γ-ray emission from F under proton bombardment may be the result of the formation of excited $^{16}O^*$ nuclei according to the process $^{19}F + {}^1H \rightarrow (^{20}Ne^*) \rightarrow {}^{16}O^* + {}^4He \rightarrow {}^{16}O + {}^4He + h\nu$, the same excited state of ^{16}O (at $6·5 \times 10^6$ e.v.) being produced for each resonance of the γ-ray excitation curve. L. S. T.

X-Ray emission from the isomers of radioactive bromine. L. I. ROUSSINOV [RUSINOV] and A. A. YUSEPOVICH [JUZEFOVITSCH] (Physical Rev., 1939, [ii], 55, 979).—Soft radiation emitted in the disintegration of the radioactive Br nucleus was measured by a Geiger–Müller counter, and results of selective absorption in As and Se agree with calc. absorption coeffs. for the $K\alpha_1$ and $K\alpha_2$ lines of Br. Absorption curves in Pb and Hg show that the radiation is due to the conversion of the Br nucleus during nuclear isomerism. N. M. B.

Isomerism of bromine. L. I. RUSINOV and A. A. JUZEFOVITSCH (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 765—770).—The disintegration of the radioactive Br of 4-hr. period is followed by emission of a soft radiation. L. J. J.

Radiobromine. R. E. SIDAY (Nature, 1939, 143, 681).—Measurements in a Wilson chamber of tracks starting from thin foils activated with 4·5-hr. radio-Br, and from active EtBr, show homogeneous energy groups of electrons due to the K and L conversion of the γ-ray, superimposed on a background of the continuous β-ray spectrum of the β-active isotope. The γ-rays have an energy of 43,000 e.v. L. S. T.

γ-Rays from radioactive iodine (^{128}I). M. A. BAK and N. N. NIKOLAEVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 312—315).—Radioactive ^{128}I has been prepared by bombarding EtI with slow neutrons ejected from Be, and extracted by pptn. with $AgNO_3$. γ-Rays were detected in the products of β-disintegration of this ^{128}I and their energies found to be ~ 4—5×10^5 e.v. The ratio of γ-quanta to β-rays is 1 : 2 or 3. T. H. G.

Unsuccessful search for transuranic elements. E. SEGRÈ (Physical Rev., 1939, [ii], 55, 1104—1105).—The activity produced in a thin U layer by neutrons is of two types : recoiling, containing only

fission products, and non-recoiling containing a 23-min. and a 2-day period (cf McMillan, A., 1939, I, 235). Since transuranics would certainly be found in the non-recoiling fraction, a detailed chemical and decay investigation of the two activities is described. Results indicate that the 23-min. U decays to a long-life 93 isotope and that there is no evidence of a transuranic element. U_3O_8 irradiated over 2 years showed no unusual α-activity to indicate a long-life emitter.   N. M. B.

Existence of trans-uranium elements. I. Non-existence of eka-platinum and eka-iridium. O. Hahn and F. Strassmann (Naturwiss., 1939, **27**, 451—453).—The element with half-life 2·5 hr., formerly called eka-Pt, is not a trans-U element, but an isotope of I. Its half-life is more accurately 2·3 hr. The element with half-life 66 hr., formerly thought to be eka-Ir, consists of two elements with the same half-life. One is a Te isotope, and gives rise to the I isotope of half-life 2—3 hr. Chemical analysis shows the other to be a Mo isotope, probably identical with that obtained by irradiation of Mo with neutrons or deuterons.   A. J. M.

Concentrating the uranium isotope of 23-minute half-life. J. W. Irvine, jun. (Physical Rev., 1939, [ii], **55**, 1105).—A method of concentrating U (23 min.) with respect to ^{238}U depends on the easier hydrolysis of U^{IV} than of U^{VI} salts. The prep. of $NaUO_2(OAc)_3$ from activated $NH_4UO_2(OAc)_3$ is described in detail and increased concn. by a factor of 10 is found.   N. M. B.

. **Simple capture of neutrons by uranium.** H. L. Anderson and E. Fermi (Physical Rev., 1939, [ii], **55**, 1106—1107; cf. A., 1939, I, 294).—The contribution of the process of simple capture of slow neutrons giving rise to U (23 min.) to the capture of thermal neutrons was investigated in order to determine whether this absorption could account for the difference between the total capture cross-section and the fission cross-section. Measurements based on a determination of the no. of disintegrations per sec. of U (23 min.) produced by thermal neutrons and of the no. of thermal neutrons effective under the conditions of irradiation are described. The vals. found are : fission cross-section 2×10^{-24}, cross-section for simple capture $1\cdot2 \times 10^{-24}$, and total absorption cross-section for thermal neutrons $3\cdot2 \times 10^{-24}$ sq. cm. compared with the val. 5×10^{-24} sq. cm. available from absorption measurements.   N. M. B.

Possibility of the disintegration of very heavy nuclei into two nuclei of medium weight. U. Fano (J. Phys. Radium, 1939, [vii], **10**, 229—233).—Theoretical. Assuming that heavy nuclei have a spherical form it can be shown that they are unstable and consequently easily disrupt into two nuclei of medium wt., in agreement with the experimental evidence of Hahn on the artificial radioactivity of U. Possible mechanisms for the fission of stable heavy nuclei by neutron bombardment are reviewed.   W. R. A.

Penetrating β–particles from uranium activated by neutrons. H. H. Barschall, W. T. Harris, M. H. Kanner, and L. A. Turner (Physical Rev.,

1939, [ii], **55**, 989).—Using two counters with a circuit for recording coincidences, measurements were made for U irradiated with fast D–D neutrons, with 1·3 mm. of Al between the U and the counters (to exclude U-X_2 β-rays). An analysis of coincidence curves from somewhat inconclusive data indicated the presence of activities (β-rays of energy $>2\cdot9$ Me.v.) of half-lives 11—15, 3·0—4·0, and 0·3—0·9 sec.   N. M. B.

Splitting of heavy nuclei by slow neutrons. J. Frenkel (Physical Rev., 1939, [ii], **55**, 987).—Mathematical. An examination of energy relations leads to three different ways of regarding the explosive rupture process.   N. M. B.

Conditions of chain transmutation of uranium. F. Perrin (Compt. rend., 1939, **208**, 1573—1575).—The crit. dimensions for unlimited branching of the chains in the rupture of U by neutrons are calc. for a mass of a U prep. containing H and Cd (cf. A., 1939, I, 351). The crit. radius for a sphere of U_3O_8 containing 3% of H_2O and 0·01% of Cd is 65 cm. at room temp., or 80 cm. at 900°.   A. J. E. W.

Production of neutrons by the fission of uranium. J. L. Michiels, G. Parry, and G. P. Thomson (Nature, 1939, **143**, 760).—Experiments showing that the processes of fission of the U nucleus by fast and possibly by slow neutrons lead to a net gain in the no. of neutrons are described.   L. S. T.

Number of neutrons liberated in the nuclear fission of uranium. H. von Halban, jun., F. Joliot, and L. Kowarski (Nature, 1939, **143**, 680).—A discussion of previous results (A., 1939, I, 233). The average no. of neutrons produced in every nucleus split is $3\cdot5\pm0\cdot7$.   L. S. T.

Neutrons produced by the disintegration of the uranium nucleus. G. von Droste and H. Redde-mann (Naturwiss., 1939, **27**, 371—372).—The production of neutrons more rapid than those formerly observed on the disintegration of the U nucleus should occur from energy considerations. The presence of such neutrons when U_3O_8 was irradiated with neutrons from Ra–Be was detected by means of a He-filled ionisation chamber with a proportional amplifier. Neutrons are also emitted after the irradiation has ceased. The rapid neutrons are emitted immediately from the U. Their energy distribution is similar to that of Ra–Be neutrons, rather than those of the D + D reaction. The no. of neutrons emitted with a half-life of 12 sec. is $<0\cdot125$ of the no. of observed rapid neutrons for energies $>1\cdot4$ Me.v., and $<1/15$ for energies $>2\cdot4$ Me.v. As no protons are emitted it is probable that the process is an independent " evaporation " of neutrons after the disintegration.   A. J. M.

Uranium fission fragments. (A) Energy distribution. (B) Range distribution. E. T. Booth and J. R. Dunning (Physical Rev., 1939, [ii], **55**, 981, 982, 1273; cf. A., 1939, I, 235).—(A) An ionisation chamber filled with A and containing a high-voltage electrode of U_3O_8 electrically deposited on Au was exposed to neutrons from a cyclotron, and the ionisation pulses for the uncollimated and collim-

ated chamber were recorded by an amplifier oscillographic system. Ionisation curves show that the fission fragments are divided into at least two major energy groups, the max. energies in each group being ~100 and 72 Me.v. The total energy for a single fission is ~175 Me.v. (a low val. probably due to excitation of the fragments), and the ratio of the masses of the two fragments ~96/140. With the collimated chamber the fragments are divided into approx. equal major groups.

(B) [With F. G. SLACK.] Using a differential ion chamber and a source deposit of U_3O_8 of 1 mm. air equiv., the range curve for collimated fission fragments shows two major groups of approx. equal intensity and with ranges $2 \cdot 2 \pm 0 \cdot 1$ and $1 \cdot 5$ cm., respectively.
N. M. B.

Fission products from uranium. G. N. GLASOE and J. STEIGMAN (Physical Rev., 1939, [ii], **55**, 982—983).—U_3O_8 was irradiated with slow neutrons and the products were collected in Cellophane. Decay curves indicate periods of ~9 hr., 80, 32, 17, and 10 min. On elimination of a group of fission products of 1·5 cm. range by Cellophane of 1·4 cm. air equiv., the products passing through this foil showed periods of ~6 hr., 35, 17, and 3 min. Gaseous products were removed and collected by passing N_2 for selective periods through irradiated U in solution. Results indicate gaseous products of periods 35 sec. and 5 min. associated with Ba (86 min.) and Rb (17 min.), respectively. The longer-range fission products are probably due to Kr–Rb–Sr rather than to Xe–Cs–Ba series.
N. M. B.

Retardation in air of atomic fragments resulting from the explosion of uranium nuclei. G. BECK and P. HAVAS (Compt. rend., 1939, **208**, 1643—1645).—Theoretical. The neutralisation of the charges on the nuclei produced by rupture occurs by electron capture from mols. in the atm., involving the Auger effect.
A. J. E. W.

Transmutation of thorium by neutrons. A. H. W. ATEN, jun., C. J. BAKKER, and F. A. HEYN (Nature, 1939, **143**, 679).—The passage of a fast stream of N_2 through a conc. solution of $Th(NO_3)_4$ containing a fast neutron source (Li + D), drying (P_2O_5), passage over active C immersed in liquid N_2, and extraction of the radioelements from the C with H_2O containing Cs·, Rb·, Ba··, Sr··, and La···, and suitable pptns. give the same periods for Rb, Ba, and Cs as found in the case of U (A., 1939, I, 234). Sr was inactive. The fission of U and Th thus leads to the same radioactive noble gases.
L. S. T.

Adaptation of a small cloud chamber to the study of electron showers. J. E. THOMAS, jun., and W. E. RAMSEY (J. Franklin Inst., 1939, **227**, 789—799).—A shower-producing Pb plate in the chamber described is provided with three counters immediately beneath it and a large no. of narrow counters are placed beneath the chamber. The simultaneous discharge of at least one of the former and any two of the latter automatically actuates the expansion mechanism and photographs the tracks of the incident ray and the shower from opposite directions normal to the plate.
L. J. J.

Disintegration of nuclei by cosmic rays. A. P. SHDANOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 731—735).—Photographic plates exposed at a height of 9000 m. show a greater frequency of nuclear disintegration than at sea level. A considerable proportion of 4- or 5-branched tracks is found, including a new type in which the five branches are coplanar; of the five, two are attributed to barytrons and three to protons. Showers of five or six particles, showing the action of protons and barytrons, are found, as at sea level; the no. of barytrons appears generally to be even. There is no evidence of increase in the no. of single tracks with height, or of swarms of particles.
L. J. J.

Recent advances in the investigation of cosmic rays. T. H. JOHNSON (J. Washington Acad. Sci., 1939, **29**, 233—256).

Magnitude distribution of ultraradiation impacts through 10 cm. of iron. A. SITTKUS (Z. Physik, 1939, **112**, 626—628).—Observations, extending over 9½ months, of impacts from cosmic rays filtered through 10 cm. of Fe show that the impact distribution curve has the form $N = N_0 \times a^{-1 \cdot 82}$ where N = frequency and a = magnitude of the impacts.
L. G. G.

Rossi transition curve for small-angle showers. W. M. NIELSEN, J. E. MORGAN, and K. Z. MORGAN (Physical Rev., 1939, [ii], **55**, 995—997; cf. A., 1937, I, 595).—Measurements of 7° and 28° cosmic-ray shower production in Fe of thicknesses up to ~320 g. per sq. cm. indicate that there is no significant difference in the ratio of counting rates at the first max. of the Rossi transition curve to that under 200 g. per sq. cm. for either large- or small-angle showers, and that the processes responsible for the character of the transition curve under large thicknesses of material are not necessarily restricted to small angles. N. M. B.

Decrease of intensity of cosmic rays in the earth down to 1380 m. water equivalent. J. CLAY and A. v. GEMERT (Physica, 1939, **6**, 497—510).—Data are recorded for threefold coincidences under varying thicknesses of clay and slate down to 1380 m. H_2O equiv., with varying thicknesses of Pb between the counters, and compared with results under H_2O (A., 1939, I, 175). The decrease depends on the electron density of the material. The primary rays still ionise down to 427 m. H_2O, so that coincidences at great depths are not due to neutrinos. The no. of secondaries and showers increases from 200 m. to 427 m. H_2O and then diminishes at greater depths. It is concluded that for ~5×10^{10} ev. the radiation of mesotrons increases, whilst rays penetrating below 427 m. H_2O are probably protons, the decrease being $\propto h^{-2 \cdot 92}$.
L. J. J.

Latitude effect of cosmic rays in the stratosphere. S. N. VERNOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 738—740).—The intensity of cosmic rays depends markedly on the latitude, indicating that electrically charged particles are concerned. Atm. absorption of cosmic rays deflected by the terrestrial magnetic field is in agreement with Bhabha and Heitler's cascade theory. The intensity-altitude curve in equatorial regions shows a max.

inconsistent with the presence of secondary γ-rays with $>12\%$ of the total cosmic ray intensity; hence before entering the terrestrial magnetic field the penetrating power of the rays is <7 cm. H_2O.

L. J. J.

Extent and penetrating power of large cosmic-ray showers. P. AUGER, R. MAZE, and ROBLEY (Compt. rend., 1939, **208**, 1641—1643),—The area affected by the showers is studied, using coincidence counters separated by varying horizontal distances (d). The no. of coincidences for large d vals. (20—300 m.) is $\gg$ that predicted by Euler's theory, probably owing to production of penetrating particles (mesotrons ?) in the showers. Approx. 10% of the showers give coincidences through 15—20-cm. Pb screens, and evidently contain mesotrons or groups of high-energy electrons. A. J. E. W.

Secondary radiation produced by the penetrating component of cosmic rays. G. C. FRANK-KAMENETZKI (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 742—743).—The intensity of the secondary radiation, determined by the Rossi–Auger method, is $4\cdot5\pm3\%$ that of the penetrating component in Pb, $11\pm3\%$ in Al, and $33\pm3\%$ in air, in contrast to the theoretical increase with at. no. for secondary δ-radiation. A considerable proportion of the soft component at sea level consists of secondary radiation.

L. J. J.

Releasing radiation for hard showers. K. SCHMEISER (Z. Physik, 1939, **112**, 501—511).—Counter tubes are so arranged above and below a Pb secondary radiator as to record, by multiple coincidence, showers produced from ionising and non-ionising radiation respectively. For Pb $1\cdot5$ cm. thick soft showers are produced chiefly from ionising particles and hard showers chiefly through photons. Hard showers from Pb 15 cm. thick are mainly due to the action of charged mesotrons and in part also to an uncharged radiation which probably consists of neutral mesotrons. L. G. G.

Cosmic-ray burst of a hundred particles. A. JDANOFF [SHDANOV] (Nature, 1939, **143**, 682).—Stereoscopic photomicrographs showing a cosmic-ray burst of $\sim$100 heavy particles on a photographic plate with thick emulsion exposed to the action of the rays are reproduced and analysed. Assuming that the particles are protons, the total energy of the burst is $\ll 200$ Me.v. The no. of disintegrations and heavy particles per disintegration increases rapidly with increasing altitude from sea level to 9000 m.

L. S. T.

Cloud chamber studies of cosmic-ray showers and penetrating particles. J. C. STREET (J. Franklin Inst., 1939, **227**, 765—788).—The statistical distribution of showers produced by successive layers of Pb of different thicknesses indicates that showers are not formed if the thickness is small compared with the free paths for radiation and pair formation according to the multiplicative theory, and that explosion showers are very rare. Examination of the range-energy relation of the penetrating particles shows considerable straggling, and supports the view that they are barytrons with mean energy $\sim$1350 Me.v.

L. J. J.

Origin of slow mesotrons. H. MAIER-LEIBNITZ (Forsch. u. Fortschr., 1939, **15**, 221—222).—Using a " slow " Wilson cloud chamber, five mesotrons have been photographed and the mass of each deduced. The mass appears to vary. The penetrating properties and probable origins of hard and of weak mesotron components of cosmic radiation are discussed. W. R. A.

Mass and mean life-time of the meson. H. YUKAWA and S. SAKATA (Nature, 1939, **143**, 761—762).—The mean life-time of the mesotron increases rapidly with a decrease in mass, but the theoretical val. is always $<$ the experimental val. of $2 \sim 4 \times 10^{-6}$ sec. found from cosmic-ray data. L. S. T.

Non-ionising particles in the penetrating component of cosmic radiation. V. I. VEKSLER (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 308—311; cf. A., 1939, I, 174).—A discussion based on Rossi's shower curves and the absorption curves of cosmic radiation leads to the probability, though not to the certainty, that there are neutral particles of high penetration in cosmic radiation. T. H. G.

Materialisation of energy. A. M. DA SILVA (Ann. Physique, 1939, [xi], **11**, 504—547).—The measurements of Skobelzyn and Stepanova (A., 1935, 425) on the effective section of materialisation of the kinetic energy of β-rays of Ra-C and its proportionality to the first power of Z of the bombarded element have been confirmed. Attempts by other investigators to prove this have been vitiated principally by faulty technique. The materialisation of a photon in the field of an electron has been observed in agreement with the theoretical predictions of Perrin.

W. R. A.

Molecular spectra of hydrogen isotopes. I. Application of the rotating vibrator model to the states of D_2. I. SANDEMAN (Proc. Roy. Soc. Edin., 1939, **59**, 1—14).—Theoretical. L. J. J.

Mass of elementary particles. A. PROCA and S. GOUDSMIT (J. Phys. Radium, 1939, [vii], **10**, 209—214).—A detailed account of work already noted (A., 1939, I, 297). W. R. A.

Ionic radius and the periodic system. E. KORDES (Z. physikal. Chem., 1939, **43**, B, 213—228).—Empirical relations between the ionic radius, at. no., and the Born repulsion exponent have been used to calculate the ionic radii of the elements. Reasonable agreement was obtained with theoretical and empirical vals. of other investigators. C. R. H.

Shape and stability of heavy nuclei. G. YOUNG (Physical Rev., 1939, [ii], **55**, 1102—1103).—Feenberg's stability criterion (cf. A., 1939, I, 237) is shown to be a special case of more general equations encountered in the biophysical theory of cell division.

N. M. B.

Theory of nuclear structure. E. U. CONDON (J. Franklin Inst., 1939, **227**, 801—816).—A survey of current nuclear theory. L. J. J.

Liquid-drop model and nuclear moments. (MISS) K. WAY (Physical Rev., 1939, [ii], **55**, 963—965).—A comparison of magnetic and electric quadrupole moments of charged spinning drops with

experimental nuclear moments shows very poor agreement.　　　N. M. B.

Non-euclidean geometry in microscopic space. J. Mariani (Nature, 1939, **143**, 683).—Theoretical.
　　　L. S. T.

Duality principle and representation of elementary corpuscles. J. Mariani (Compt. rend., 1939, **208**, 1630—1632).—Mathematical.
　　　A. J. E. W.

Angle dependence and range of nuclear forces. D. R. Inglis (Physical Rev., 1939, [ii], **55**, 988).—Mathematical.　　　N. M. B.

Fatigue phenomena of electron-irradiated luminous substances. W. Grotheer (Z. Physik, 1939, **112**, 541—559).—The substances to be examined are supported on the screen of a modified cathode-ray tube, and the intensity of the emitted light is determined with a photo-electric cell. The intensity of light emission during irradiation with electrons decays approx. exponentially, reaching a finite val. >0, due to a simultaneous regeneration effect. A theoretical explanation of the phenomena is given.
　　　L. G. G.

Light intensity of a black body at the temperature of solidifying platinum. H. Willenberg (Physikal. Z., 1939, **40**, 389—394).—The new unit of light intensity to be introduced from Jan. 1, 1940, is defined as follows : the light intensity of a black body at the f.p. of pure Pt (2047° K.) is 60 new units per sq. cm. The calibration of photometer lamps intended for international comparison determinations with the new units is described.　　　A. J. M.

Band spectrum of HS. (Miss) N. Lewis and J. U. White (Physical Rev., 1939, [ii], **55**, 894—898).—The absorption spectrum of HS was obtained by passing repeated flashes from a source of continuous background through a discharge tube in which HS radicals are formed from H_2S by pulses of radiofrequency current synchronised immediately to precede the flashes. The spectrograms show one $^2\Sigma \to \Pi$ band at 3237 A. Data are tabulated, structure and analysis are discussed, and consts. are evaluated.
　　　N. M. B.

Explanation of the intensity distribution in the spectrum of aluminium hydride. G. Stenvinkel (Naturwiss, 1939, **27**, 370).—Schüler et al. (A., 1939, I, 177), from experiments with the spectrum of AlH excited in a discharge using a hollow cathode cooled in liquid air, conclude that AlH is not formed in the gas space. This is not confirmed by experiments with the King oven, and an alternative explanation of the intensity distribution in the spectrum of AlH is proposed.　　　A. J. M.

Electronic spectrum of selenium dibromide vapour. M. Wehrli (Helv. Phys. Acta, 1936, **9**, 329—330; Chem. Zentr., 1936, ii, 3982).—The spectrum has been studied by heating Se_2Br_2 in an absorption tube allowing independent variation of the temp. of the tube (θ_t) and the substance (θ_s). Diffuse absorption bands in the greenish-blue region (θ_t 170°, θ_s 165°) are attributed to $SeBr_2$ by analogy with $TeBr_2$. The bands form a fluctuation spectrum or a discrete system with strong predissociation of the excited state. A continuum, spreading from short to long $\lambda\lambda$, appears on raising θ_s or θ_t. The higher vibrational levels of the ground state are the most fully occupied. Thermal dissociation is not detected at 415°. The reaction $2SeBr_2 = Se_2Br_2 + Br_2$ probably occurs on condensation.　　　A. J. E. W.

Absorption spectra of permanganate, chromate, vanadate, and manganate ions in crystals. J. Teltow (Z. physikal. Chem., 1939, **43**, B, 198—212).—Absorption in the visible and ultra-violet regions at −253° has been examined for mixed crystals of $KMnO_4$–$KClO_4$, K_2CrO_4–K_2SO_4, Na_3VO_4–Na_3PO_4, and K_2MnO_4–K_2SO_4. The data are discussed from the viewpoint of chemical union.
　　　C. R. H.

Isotope effect in the line absorption spectrum of uranyl nitrate. G. Joos and B. Duhm (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, **2**, 123—126; Chem. Zentr., 1936, ii, 4094).—The absorption lines of $UO_2(NO_3)_2,6H_2O$ (at 20—83° K.) are displaced ~2 A. towards shorter $\lambda\lambda$ on replacement of the H_2O by D_2O. The ν differences of homologous lines due to $UO_2^{\cdot\cdot}$ remain const. Lines with smaller ν vals. (due to $UO_2^{\cdot\cdot}$ associated with H_2O or D_2O mols.) are displaced further. A rise of temp. causes similar displacements, as an increase in the intensity of the field around the excited electron may be caused by a temp. rise, or by a decrease in the zero-point energy due to introduction of D.
　　　A. J. E. W.

Constitution of mercurithiocyanates. F. Gallais (J. Chim. phys., 1939, **36**, 99—101; cf. A., 1938, I, 558).—To account for the abnormally high light absorption and magnetic rotatory power of mercurithiocyanates as compared with mercuricyanides, it is suggested that isomerisation of CNS occurs during their formation in aq. solution. Comparison of the absorption and magnetic rotation of EtSCN with those of EtNCS shows considerably higher vals. for the latter and thus supports the view that the complexes in question should be represented as mercuri*iso*thiocyanates.　　　F. L. U.

Ozonisation of allyl-, propenyl-, and α-methylvinyl-benzene. Results of physico-chemical determinations (Raman spectra, ultra-violet absorption spectra, dielectric constants, and dipole moments). E. Briner, K. Ryffel, and E. Perrottet (Helv. Chim. Acta, 1939, **22**, 927—934).—The quant. ozonisation of allyl- (I), propenyl- (II), and α-methylvinyl- (III) -benzene has been studied. The ozonide (IV) of (I) is sufficiently stable to permit its isolation and the measurement of its physical consts. In the Raman spectra of the three isomeric hydrocarbons the frequency of the double linking increases in the sequence (II), (I), (III) as observed previously in other series. In the Raman spectrum of (IV) there is no frequency for a double linking, but other new frequencies appear. The addition of O_3 to the mol. of (I) causes a shift of the absorption band (~400 A.) towards longer $\lambda\lambda$. The dipole moments of (I), (II) and (III) are almost the same. The dielectric const. of (IV) increases with the time as observed with other ozonides. The dipole moment of (IV) somewhat exceeds that of (I) but the

relatively small increase shows that the electric symmetry is little altered by the addition of 3 O to the hydrocarbon mol.　　　　　　　　　　　H. W.

Ultra-violet absorption spectra of salicylic acid and lithium salicylate vapours. C. S. PIAW (Compt. rend., 1939, **208**, 1563—1565).—The vapours (at 130—220°) give absorption max. at ~ 3050 A. (A-region), 2385, 2349, and 2317 A. (B-region), and continua at <2250 A. These data confirm that the B-bands, which also occur with the aq. acid (I) (cf. A., 1939, I, 354), are due to the undissociated mols., and that the A-bands given by (I) at ~ 2960 and 3006 A. are due to ionised, and to ionised and neutral, mols., respectively. The three B-bands do not belong to a single electronic system, but give two vibrational w (642, 555 cm.$^{-1}$), which are attributed to normal and electronically excited states, respectively.
　　　　　　　　　　　　　A. J. E. W.

Optical properties and structure of cyano-camphor. J. P. MATHIEU and M. RONAYETTE (Compt. rend., 1939, **208**, 1567—1569).—The absorption coeff. (k), circular dichroism ([Δ]), and [α] for cyanocamphor (I) in a no. of solvents, at 2500—6000 A., are studied. The C:O absorption band has a broad max. at 2900 A. The variation of [Δ] in this region is complex, and the [Δ]/λ curve is resolvable into three curves of the Lowry–Hudson type, which (except at low $\lambda\lambda$) satisfactorily account for the observed variation of [α] with λ. The solutions exhibit mutarotation, which is accelerated by a rise in temp. or the presence of H_2O or bases; the mutarotation is not due to keto–enolic isomerism or to the formation of a structure such as $C_8H_{14}{<}^{C:C:NH}_{CO}$, as the intensity of the C:O band remains const. The Na derivative probably has a structure of the above type (cf. A., 1905, i, 112), solutions of (I) in NaOH giving much higher vals. of k. The mutarotation is probably caused by interchange of the H and CN associated with the CO group.　　　A. J. E. W.

Absorption spectra of the compounds formed by androsterone and testosterone in the m-dinitrobenzene reaction.—See A., 1939, II, 378.

Absorption spectra of some naturally-occurring naphthaquinones and their derivatives. R. G. COOKE, A. K. MACBETH, and F. L. WINZOR (J.C.S., 1939, 878—884).—The absorption spectra of lapachol and lomatiol agree with that of phthiocol (A., 1937, II, 460) as anticipated, and their derivatives of 1 : 4- (I) and 1 : 2-naphthaquinone (II) structure show max. characteristic of α- and β-naphthaquinones. The absorption curve of dunnione confirms the (II) structure suggested by Price and Robinson (A., 1938, II, 375) and is almost identical with that of dehydro-*iso*-β-lapachone. α- and β-unsaturation in the side-chain of (I) and (II) results in the appearance of an inflexion in the absorption spectra instead of the band at ~ 3330 A. characteristic of the C:O group in the system C:C·C:O, and in the displacement of the long-λ bands to greater $\lambda\lambda$. The absorption spectrum of dehydrolapachone favours the β-quinonoid structure. The prep. of *lapachol acetate*, m.p. 65—66°, and *lapachol Me ether*, m.p. 53°, is described. W. R. A.

Absorption spectra of single crystals of hæmoglobin in polarised light.—See A., 1939, III, 785.

Oscillation frequencies of nitrates. D. WILLIAMS and L. DECHERD (J. Amer. Chem. Soc., 1939, **61**, 1382—1384).—The infra-red absorption spectra of aq. $LiNO_3$, $NaNO_3$, and KNO_3 have been studied in cells with thin fluorite windows between 6 and 16 μ. and are compared with existing infra-red and Raman data for solutions and cryst. solids.　　W. R. A.

Infra-red plecchroism and Fermi resonance associated with CH_2 groups in crystals. J. W. ELLIS and (MISS) J. BATH (Physical Rev., 1939, [ii], 55, 1098—1099).—The absorption bands near 1·7 μ., including the first harmonics of the C–H valency vibrations, and the pleochroism displayed by the dependence of these bands on the azimuth of vibration of the electric vector of the light are discussed for crystals of $C(CH_2 \cdot OH)_4$ and diketopiperazine.
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Structure of ethylene. H. W. THOMPSON (Trans. Faraday Soc., 1939, 35, 697—701; cf. A., 1937, I, 500).—Detailed analysis of the absorption bands with centres ~ 9875 and 9714 A. leads to vals. of moments of inertia of the mol. which agree very closely with those derived from independent data. Vals. of mol. dimensions finally adopted are : $r_{CH} = 1 \cdot 085$, $r_{CC} = 1 \cdot 331$ A.; angle $\widehat{HCH} = 118°$.
　　　　　　　　　　　　　F. L. U.

Infra-red bands and association of some hydroxylic compounds. H. W. THOMPSON (J. Amer. Chem. Soc., 1939, **61**, 1396—1400).—The O–H absorption between 8000 and 10,000 A. has been investigated for $OH \cdot [CH_2]_2 \cdot CN$ (I) (liquid at 4 temp. between 25° and 150°), $OH \cdot [CH_2]_3 \cdot CN$ (II) (liquid at 25° and 150°), $OH \cdot [CH_2]_2 \cdot SH$ (III) (liquid at 25° and 90°; also in CCl_4 solution), $OH \cdot [CH_2]_2 \cdot NH_2$ (IV) (liquid at 25° and 100°; vapour), and $OH \cdot CMe_2 \cdot CN$ (V) (liquid at 25° and 100°; vapour at ~ 1 atm.). (I), (II), (III), and (V) give spectra similar to that of EtOH, and indicate extra-mol. association. Rise of temp. causes increased intensity of the band at 9650 A. due to dissociation of the associated mol. There are also bands at ~ 9050 A. due principally to $4\nu_{CH}$ but with apparently some superposed band connected with association. The spectrum of the vapour of (V) is complicated by the absorption by decomp. products of (V) in the region studied. (IV) gives a particularly complicated spectrum.　　　W. R. A.

Infra-red absorption spectra of acetaldehyde, paraldehyde, α- and β-trithioacetaldehyde. H. GERDING and J. LECOMTE (Rec. trav. chim., 1939, 58, 614—637).—The infra-red absorption spectra of gaseous and liquid MeCHO (7—14 μ.), liquid paraldehyde (I) (7—20 μ.), solid α- and β-trithioacetaldehyde (II) (7—14 μ.), and their solutions in CS_2 (7—20 μ.) have been determined. The findings are correlated with the Raman spectra (cf. A., 1939, I, 403) and the assignment of frequencies is discussed. The mol. of (I) is not plane, and there is probably inner equilibrium in the liquid between *cis*- and *trans*-forms. (II) also has a non-planar configuration and the β-form has the *cis*-configuration.　　　F. J. G.

Infra-red absorption spectra of monosubstituted naphthalene derivatives. J. LECOMTE (Compt. rend., 1939, 208, 1636—1638).—The infrared absorption spectra of α- and β-$C_{10}H_7X$ [X = OH, NH_2, Me, CN (β), Cl, Br, I, and NO_2 (α)] have been studied in the region 500 to 1200 cm.$^{-1}$ The results, supplemented by Raman data, confirm that the mols. have a plane of symmetry, and provide a scheme of vibrational vv for the monosubstituted compounds. The paucity of Raman lines is probably due to the occurrence of numerous oblique vibrations which, although not forbidden in scattering, do not give Raman vv. The vv of $C_{10}H_8$ occur, slightly displaced, with $C_{10}H_7X$, showing the predominant effect of the aromatic nucleus. The α-linking vv occur at 638—700 cm.$^{-1}$; the β-linking ν in $C_{10}H_8$ is possibly 961 cm.$^{-1}$ A. J. E. W.

Depolarisation measurements on Raman lines by an easy, accurate method. F. F. CLEVELAND and M. J. MURRAY (J. Chem. Physics, 1939, 7, 396—400).—Depolarisation factors (ρ) of Raman lines are measured by interposing, between the Raman tube and the lens condensing scattered light on the spectrograph slit, a Polaroid disc oriented in such a way that it passes light which has its electric vector horizontal. Two exposures of equal duration are taken, one with the arc below the Raman tube and the other with the arc at the side of the tube. The ratio of the two intensities (ρ) is obtained by comparison with lines in a series of spectra of A, intensity range 1 : 7. Advantages over other methods and data for CCl_4 and C_6H_6 are discussed. W. R. A.

Raman spectrum and structure of chloric, bromic, and iodic acids. R. FONTEYNE (Natuurwetensch. Tijds., 1939, 21, 141—144).—Raman spectra of $HClO_3$ and $HBrO_3$ solutions show that they contain only ClO_3' and BrO_3' of symmetry C_{3v}. The valency force and the angle formed by the sides of the pyramid and the perpendicular to the base are smaller than for the ions from the Na salts. Solutions of HIO_3 contain IO_3' of symmetry C_{3v}, and the pseudo-acid $HO\cdot IO_2$. Very conc. solutions also contain I_2O_6''. S. C.

Lattice oscillations in crystals. (SIR) C. V. RAMAN and T. M. K. NEDUNGADI (Nature, 1939, 143, 679).—Photographs of the spectra of the 4358 A. Hg arc line scattered by a $NaNO_3$ crystal set successively in 3 mutually perpendicular directions to the incident polarised light show that when the optic axis of the crystal is parallel to the direction of observation the lattice lines disappear. Other lines ascribed to the internal oscillations of NO_3' appear strongly in this position, and also in one of the positions perpendicular to it, but are weak in the third position when the incident light-vector is along the optic axis of the crystal and the polarisability of NO_3' is a min. L. S. T.

Raman effect. C. Esters of boric acid. L. KAHOVEC (Z. physikal. Chem., 1939, 43, B, 109—118).—Data for the esters of boric acid, $B(OX)_3$ (X = Me, Et, Bu^a, Bu^β, sec.-Bu, Bu^γ, Ac), are recorded and discussed. From $B(OAc)_3$ and the appropriate alcohol sec.-, b.p. 83·5—84·5°/13 mm., 185°/760 mm. (decomp.), and tert.-Bu borate, b.p. 59·5—60·5°/12 mm., m.p. ∼12°, were prepared. $B(OAc)_3$ has m.p. 147—148° when cryst. from AcOH and from $CHCl_3$. W. R. A.

Molecular complexes in chloroform solution. G. V. L. N. MURTI and T. R. SESHADRI (Current Sci., 1939, 8, 209).—Unsaturated carbonyl compounds in $CHCl_3$ show a shift of the Raman line for the CO: group to lower frequencies, attributed to H bonding. S. H. H.

Effect of temperature on the characters of the wings accompanying the Rayleigh lines in liquids. K. BAPAYYA (Proc. Indian Acad. Sci., 1939, 9, A, 404—409).—The depolarisation of the continuous wing exhibited by C_6H_6 and $CHCl_3$ has a limiting val. of 0·86 at all places and does not alter with temp. The depolarisation factor for the total scattering in C_6H_6 falls from 0·44 at 30° to 0·11 at 260°. W. R. A.

Raman effect. CI. Iodine derivatives $X\cdot CH_2I$. W. BACHER and J. WAGNER (Z. physikal. Chem., 1939, 43, B, 191—197).—Data for CH_2ClI, CH_2BrI, CH_2I_2, CH_2PhI, $CH_2\cdot CH\cdot CH_2I$, and CH_2ClBr are recorded. C. R. H.

Raman effect. XCVII. Poly-substituted benzene. (XII). para-Derivatives. O. PAULSEN. **XCVIII. (XIII). Analysis of "para" spectra.** K. W. F. KOHLRAUSCH and O. PAULSEN (Monatsh., 1939, 72, 244—267, 268—289).—XCVII. Raman vv, intensities, and in most cases depolarisation factors, of PhOMe and of the following p-substituted C_6H_6 derivatives are recorded : C_6H_4ClBr, $C_6H_4X_2$ (X = OMe, OH, Cl, I), $NH_2\cdot C_6H_4\cdot X$ (X = OH, Cl, I, NH_2), C_6H_4MeX (X = OH, F, Cl, Br, I, NH_2, Me, OMe), $OMe\cdot C_6H_4\cdot X$ (X = NH_2, OH, F, Cl, Br, I). The influence of substituent groups on the val. of characteristic vv of PhMe and PhOMe, and on the vals. of the inner vv of Me and OMe, is considered.

XCVIII. A collation of data on p-substituted derivatives of C_6H_6. Observed vv of C_6H_6 and $C_6H_4X_2$ (X = Me, Cl, Br) are compared with vals. deduced from mechanical models. Symmetry properties of C_6H_6, p-$C_6H_4X_2$, and p-C_6H_4XY are considered. The influence of X and Y on the CH deformation frequency at ∼1176 cm.$^{-1}$ and the frequency shifts arising from the transformations, $C_6H_6 \rightarrow C_6H_4X_2 \rightarrow C_6H_4$ and $C_6H_6 \rightarrow C_6H_4XY \rightarrow C_6H_4$, are discussed. W. R. A.

Raman spectra of acetaldehyde and paraldehyde. H. GERDING and G. W. A. RIJNDERS (Rec. trav. chim., 1939, 58, 603—608).—The findings agree in the main with those of other workers (A., 1934, 473; 1937, I, 220, 345). Minor divergences are discussed. Rise of temp. from 15° to 59° has no influence on the Raman spectrum of paraldehyde. F. J. G.

Raman spectra of α- and β-trithioacetaldehyde and of monothioparaldehyde. H. GERDING and J. G. A. KARSTEN (Rec. trav. chim., 1939, 58, 609—613).—The Raman spectra of the three substances in solution in CCl_4 have been determined. The α-form of $C_6H_{12}S_3$ has the lower symmetry and is therefore the trans-form, as suggested on chemical grounds by Chattaway and Kellett (A, 1930, 1022). F. J. G.

Luminescence of adhesive tape [and other substances]. E. N. HARVEY (Science, 1939, **89**, 460—461).—The greenish luminescence which occurs when adhesive tape is stripped from a roll is due to an electrical discharge, for in Ne a reddish luminescence is obtained. Allied phenomena shown by a large no. of substances, including discharges from tribo- or piezo-electricity, are described. Collodion films are the most striking luminescent bodies. A. E. M.

Chromoisomerism of diphenylamine derivatives.—See A., 1939, II, 363.

Influence of the electric field on the form of electro-photo-luminescence emission bands. G. DESTRIAU and G. LOUDETTE (Compt. rend., 1939, **208**, 1569—1571).—The intensity of luminescence induced by high a.c. potentials (cf. A., 1939, I, 126) is given by the expression $I = Ae^{-B/V}$; the const. B varies with λ, and the form of the α-emission band is therefore dependent on the applied potential, V. B falls with increasing λ with ZnS–CdS and ZnS–Mn phosphors, but rises with a ZnS–Cu phosphor. A. J. E. W.

Quenching of fluorescence and photothermal decomposition of aniline. A. T. VARTANIAN (J. Phys. Chem. Russ., 1938, **12**, 308—325).—The fluorescence of NH_2Ph vapour at $p = 0.02$ mm. Hg at room temp. is quenched by O_2 more strongly than by NH_3 or H_2; the calc. effective cross-sections of these mols. are 74, 5, and 0.67×10^{-16} sq. cm. respectively. The intensity of the fluorescence of NH_2Ph at const. p decreases with rising temp. (18—400°); the allowance for the increase of absorption due to the v.d. increasing with temp. is not sufficient to explain it. The absorption per mol. for 2650 and 2800 A. is independent of temp. Heating of NH_2Ph to 400° in vac. has no effect but heating and irradiation in a quartz vessel produce new substances which apparently include H_2, NH_3, and N_2H_4 in addition to a fluorescent and a solid substance. J. J. B.

Fluorescence and absorption measurements on benzene derivatives, particularly condensed systems. H. LEY and H. SPECKER (Z. wiss. Phot., 1939, **38**, 13—27).—Fluorescence and absorption spectra of C_6H_6, CH_2Ph_2, $(CH_2Ph)_2$, $(CHPh:)_2$, α-methylstilbene, $(:CPh_2)_2$, $(CH_2Ph\cdot CH:)_2$, $NHPh_2$, Ph_2O, Ph_2S, PhOH, PhSH, fluorene, diphenylene oxide and sulphide, carbazole, and Ph_2 are given. W. R. A.

[Factors] influencing the luminescence of lucigenin [dimethyldiacridylium nitrate]. O. SCHALES (Ber., 1939, **72**, [*B*], 1155—1160).—The luminescence of lucigenin (I) due to reaction with H_2O_2 occurs in alkaline solution only, and becomes undetectable below p_H 9.08. It is most intense with 0.375N-NaOH, and the half-life period decreases with increasing [NaOH] between 0.125 and 2.5N. (I) can be used to detect 1 in 100,000 of H_2O_2, but is much less sensitive for this purpose than luminol (3-aminophthalhydrazide) (cf. A., 1939, I, 151). Hitherto only OsO_4 has been found to catalyse the luminescence of (I) with H_2O_2. F. L. U.

Semi-conductors in intense fields and their rectifying action. A. F. JOFFE (Bull. Acad. Sci., U.R.S.S., 1938, Sér. Phys., 617—624). L. J. J.

Theory of rectification in semi-conductors. B. J. DAVIDOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 625—630).—The concns. of free charge near the junction of two semi-conductors having different types of conductivity is influenced by passage of a current through the junction. This produces an additional resistance dependent on the direction of the current. L. J. J.

Semi-conductors in strong electric fields. N. L. PISARENKO (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 631—640).—Increased concn. of free electrons in semi-conductors may be produced by an intense electric field by ionisation of atoms of impurities or of the semi-conductor, either through the tunnel effect, or through a decrease in electron bond energy produced by the field, or by collision with neutral atoms of conductivity electrons accelerated by the field. L. J. J.

High-voltage polarisation in cuprous oxide and selenium at low temperatures. V. I. LJASCHENKO and G. A. FEDORUS (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 641—650).—Nasledov and Nemenov's observation (cf. A., 1935, 1303) of potential jumps at the electrodes at low temp. independent of the direction of the field is confirmed for Cu_2O and Se, and in addition a high-voltage polarisation causing a potential jump which depends on the direction of the field is recorded. L. J. J.

Internal photo-electric effect. P. S. TARTAKOVSKI (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 689—694).—Alkali halide crystals, either unactivated or containing U-centres, show an internal photoelectric effect and fluorescence in the ultra-violet, analogous to those found in the presence of F-centres. The photo-electrons leave the conductivity zone at the end of their path, and reach the F' level. L. J. J.

Thallium sulphide photo-cells with " positive " photo-effects in the blocking layer. B. T. KOLOMIETZ (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 695—704).—The sign of the conductivity of semi-conducting Tl_2S determines that of the photo-effect. " Positive " photo-effects are produced by electron transfer from the metal into free energy levels produced by the action of light on the semi-conductor. " Positive " photo-cells have a wide region of spectral sensitivity with a max. at 1 μ., and have 65 times the X-ray sensitivity of Se cells. Temp. has a marked effect. L. J. J.

Spectral characteristics of selenium photo-elements. E. K. PUTSEIKO (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Phys., 713—720).—Admixtures of traces of S and Te cause displacements of the spectral sensitivity curve of Se towards short and long λλ, respectively. L. J. J.

Dielectric properties of fused basalt. A. G. ANSHUR (Trav. Univ. Etat Arménie, 1934, [i], **1**, 28—33; Chem. Zentr., 1936, ii, 4194).—The sp. resistance is 10^{13} Ω. ε (7—18) varies only slightly with ν, and dielectric losses are low. The breakdown voltage is ~70 kv. per cm. Possible applications are discussed. A. J. E. W.

Relations between certain properties of gases and vapours, in connexion with absorption by them of high-frequency electrical fields. E. K. ZAVOJSKI and S. G. SALICHOV (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 101—114).—Absorption of a high-frequency electrical field by vapours or gases is given by $Q = \beta T + \alpha$, where T is the temp., β is a const., the val. of which depends on the no. of atoms per mol. of the given gas, and α is a characteristic const. for each gas. An empirical equation connecting dQ/dT with the dipole moment, and its temp. coeff., is given. Identical vals. of β are found for $COMe_2$, Et_2O, $EtOAc$, $EtOH$, C_6H_6, and CO_2; β for diat. gases (air, O_2, N_2) is 1·4 times as great as for the preceding group, whilst for highly asymmetrical mols. (HCl, HBr, NH_3) β is still higher.   R. T.

Conductivity of apolar amorphous substances, in the softening zone. J. J. JANSON (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 127—147).—The conductivity of paraffin wax rises to a max. at 25°, then falls to a min. at 35°, and again rises sharply at 40°. In the softening zone (40—49°) paraffin behaves similarly to amorphous polar substances.   R. T.

Theory of the mercury-vapour lamp. A. J. NIKIFOROV (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 115—120).—It is shown, on theoretical grounds, that the temp. at the Hg cathode is $\nrightarrow$235°, whence it follows that maintenance of the arc by thermionic emission of electrons is improbable.   R. T.

Dependence of absorption of weak high-frequency electrical fields by certain substances on the tension of these fields. B. M. KOZIREV and S. G. SALICHOV (Sci. Mem. Kazan State Univ., 1938, 98, No. 4, 149—152).—Absorption falls linearly with increasing tension of the field in the case of H_2O; with C_6H_6, PhMe, xylene, EtOAc, and $H_2C_2O_4$ the curves are discontinuous.   R. T.

Dielectric constants of ammonium salts near the lower transition temperature. I. Ammonium chloride and bromide. J. H. BRUCE (Trans. Faraday Soc., 1939, 35, 706—711).—When NH_4Cl and NH_4Br are cooled an abrupt fall of ϵ occurs at —30·5 and —38°, respectively. Hysteresis is observed on warming.   F. L. U.

Dielectric constants of the ammonium halides. R. GUILLIEN (Compt. rend., 1939, 208, 1561—1563). —ϵ/θ curves (0° to —80° or to —200°) are given for the four halides. ϵ for NH_4F decreases slowly on cooling, and increases slightly (0·06%) at the λ-point. NH_4I gives pronounced max. vals. of the dielectric const. ϵ' and the electric absorption ϵ'' at the λ-point (—28·5°), and smaller peaks due to the change of cryst. form occur at —5·9°. Powdered NH_4Cl and NH_4Br give similar results, a break in the ϵ/θ curve occurring at the λ-point, but ϵ increases to a greater extent on transformation into the simple cubic form. Sheets cut from blocks of fibrous NH_4Cl give a sharper peak at the λ-point on cooling, the difference being due to a false equilibrium between the two states.   A. J. E. W.

Dielectric constant, dipole moment, and molecular polarisation of 1 : 4-dioxan. W. C. VAUGHAN (Phil. Mag., 1939, [vii], 27, 669—671).—Vals. of ϵ for the range 14—87° are recorded ($\epsilon_{25°} = 2·280$); they diminish as the temp. rises. The mol. polarisation is 25·71 and practically independent of temp.; $\mu = 0$. The similarity between certain properties of dioxan and C_6H_6 is noted.   W. R. A.

Dipole moments of organic molecules containing oxygen. E. A. SCHOTT-LVOVA and J. K. SIRKIN (J. Phys. Chem. Russ., 12, 479—480).—The dipole moments of various aromatic compounds containing OH, CHO, and OMe are recorded.   R. C.

Steric influences on the phenomenon of resonance. II. C. E. INGHAM and G. C. HAMPSON (J.C.S., 1939, 981—986; cf. A., 1937, II, 92).—Previous measurements on the dipole moments of substituted durenes showed that with a branched substituent the steric effects of the Me groups reduced the mesomeric moment, the measured moment lying between the vals. for the corresponding C_6H_6 and alkyl compounds. When the substituent was a single atom, no steric influences were involved and the moment of the durene compound was the same as that of the corresponding C_6H_6 derivative. These conclusions have been confirmed by work at 25° on C_6H_6 solutions of mesidine, dimethylmesidine, durenol, *nitrodimethylaminodurene*, m.p. 90°, *nitroethoxydurene*, m.p. 75·5°, *nitrodurenol*, m.p. 123—124°, and 2-*nitro*-m-5-*xylidine* (I), m.p. 131·6°. A comparison of the moment of (I), in which only the NO_2 is blocked by Me groups, with those of p-$NO_2 \cdot C_6H_4 \cdot NH_2$ and nitroaminodurene shows that the steric effect of the o-Me on the large O of the NO_2 is more important than that on the H of the NH_2. The anomalous behaviour of m-2-xylidine on nitration (4- and 6-positions but not 5-) is attributed to the steric effect of the o-Me which reduces the resonance, and hence the directing power of the NH_2, to such an extent that the Me become the main directive influences.   W. R. A.

Refractive indices and molecular refractivities of 3-methyl*cyclo*hexanone and pulegone. (MISS) D. M. SIMPSON (J.C.S., 1939, 886—889).—Vals. of n have been obtained for λλ from ~2500 to ~7000 A. by the thin film interference method. Both compounds show " optical exaltation " which substantiates the conclusion (A., 1936, 409) that the additivity of at. refractivities occurs only for mols. which do not show strong absorption bands in the accessible ultra-violet.   W. R. A.

Rotatory dispersion and circular dichroism of santonide and parasantonide in the ultra-violet. S. MITCHELL and K. SCHWARZWALD (J.C.S., 1939, 889—893).—Santonide (I) and parasantonide (II) show the Cotton effect associated with a strong ketonic band which in EtOH solution has its max. at ~3000 A. For (I) $\epsilon_{max.} = 1000$, $[\alpha] = +25,500°$ at 3210 A., —31,000° at 2750 A.; for (II) $\epsilon_{max.} = 1170$, $[\alpha] = +32,000°$ at 3210 A., —35,000° at 2750 A. The vals. of $[\alpha]$ are ~10 times the normal val. The max. of circular dichroism ($\epsilon_l - \epsilon_r$) are also abnormally large, but the anisotropy factors $(\epsilon_l - \epsilon_r)/\epsilon$ have normal vals. of 0·030 (I) and 0·038 (II).   W. R. A.

Loss determinations for dipole liquids and solid technical insulators for centimetre waves.

G. Bäz (Physikal. Z., 1939, 40, 394—404).—Optical methods for the determination of the variation of n, and the absorption coeffs. of H_2O, MeOH, and EtOH in their dispersion ranges for cm. waves are described. The dispersion curves are continuous with those obtained for longer λ. The dielectric consts. and angles of loss for a no. of solid insulators have been determined by the same method and over the same λ range, as well as for longer λ (100—3000 m.). The angle of loss increases with frequency. Dispersion for cm. waves was not observed with solid insulators.

A. J. M.

Dynamic birefringence effect obtained during extension of a liquid film. G. Duch (Compt. rend., 1939, 208, 1571—1572).—If a rectangular frame is withdrawn vertically from a liquid (C_6H_6 or H_2O) between crossed nicols, light is transmitted through two narrow bands parallel to the top of the frame. The positions of these bands probably correspond with max. in the traction curve for the film. The dynamic effects thus arise in the film, and do not depend on the nature of the support.

A. J. E. W.

Nature of the most important kinds of chemical linking. E. Thilo (Chem.-Ztg., 1939, 63, 449—453).—A lecture.

Structure of phosphorus pentachloride in relation to the steric obstruction of atoms. H. Moureu, A. M. de Ficquelmont, M. Magat, and G. Wetroff (Compt. rend., 1939, 208, 1579—1581).—The trigonal bipyramid structure for PCl_5 (cf. A., 1937, I, 496; 1938, I, 606) provides for the most probable P—Cl distance (2·09 A.) and the most stable distance of approach ($\sim$ 3·70 A.) of two Cl which are not directly linked. Other structures involve less favourable vals. for these distances.

A. J. E. W.

New proof of the H theorem. O. Halpern and F. W. Doermann (Physical Rev., 1939, [ii], 55, 1077—1082).—Mathematical. The new proof of Boltzmann's H theorem is based on the properties of the probability coeffs. which determine the transitions between different states of the total system or of any part of the system.

N. M. B.

Diffraction of a current of chemical molecules. W. Krejczy (Nature, 1939, 143, 762).—Weak chemical linkings may be broken by scattering at incidence on a diffraction grating.

L. S. T.

Zero-point energy and lattice distances. J. Corner (Trans. Faraday Soc., 1939, 35, 711—716).—Taking into account the increase of the lattice const. due to the introduction of the zero-point energy, approx. intermol. potentials are calc. for Kr, Xe, CO, and CH_4. The correction greatly reduces the discrepancy between vals. of n (exponent of intermol. distance) deduced from heats of sublimation and lattice consts.

F. L. U.

Kinetic energy of polyatomic molecules. A. Sayvetz (J. Chem. Physics, 1939, 7, 383—389).—Mathematical. Linear tetrat. mols., anomalous XY_3 mols., and C_2H_6 are discussed.

W. R. A.

Relation between internuclear distance, force constant, and energy of dissociation for carbon-to-carbon linkages. J. J. Fox and A. E. Martin (J.C.S., 1939, 884—886).—A relation $D = k_e r_e^2 / mn$ is combined with $k_e r_e^5 =$ const., and it is shown that $Dr_e^3 =$ const. When U/D is plotted against r/r_e a Morse type of curve, applicable to all C-to-C linkages, is obtained.

W. R. A.

Carbon–chlorine bond in the substituted ethylenes and benzenes. J. Sherman and J. A. A. Ketelaar (Physica, 1939, 6, 572—579).—The amount of double-bond character in the C–Cl bonds in the choro-ethylenes and -benzenes, calc. by the mol.-orbital method, is in agreement with experimental vals. for resonance-shortening of these bonds obtained from electron diffraction data.

L. J. J.

Surface tension and Lindemann frequency. L. Sibaiya and M. R. Rao (Nature, 1939, 143, 723).—A simple formula expressing γ in terms of mol. mass and the Lindemann frequency is deduced.

L. S. T.

Identity between the Laue equation and the Bragg relation. A. Cavinato (Z. Krist., 1939, 100, 439—440).—An elementary mathematical demonstration.

I. McA.

Quantum-mechanical theory of X-ray interference in crystals. I. Derivation and general discussion of dynamical fundamental equations. G. Molière (Ann. Physik, 1939, [v], 35, 272—296).

W. R. A.

Quantum mechanical theory of Röntgen-ray interference in crystals. II. Dynamic theory of refraction, reflexion, and absorption of Röntgen rays. G. Molière (Ann. Physik, 1939, [v], 35, 297—313; cf. supra).—An anisotropy with respect to X-rays and a change in the limiting angle of the Bragg total reflexion area are predicted and should be of observable magnitude in the neighbourhood of the absorption edge.

O. D. S.

L_{III} Absorption of iodine, barium, and some compounds of barium. E. H. Green (Physical Rev., 1939, [ii], 55, 1072—1076).—The L_{III} absorption limits of I_2, Ba, BaI_2, $Ba(OH)_2$, $BaBr_2$, BaH_2, $Ba(NO_3)_2$, BaO_2, and BaF_2, were examined with a two-crystal spectrometer. No secondary structure was detected in the I_2 limit; a prominent absorption line was observed for Ba and each of its compounds, more prominent in the compounds than in the element. Some of the compounds, notably BaF_2, showed secondary structure, and curves were obtained showing the changes as Ba absorbers changed in air to $Ba(OH)_2$. The L_{III} level of Ba is not wider than 4·06 v.

N. M. B.

Structure of iron pentacarbonyl and of iron and cobalt carbonyl hydrides. R. V. G. Ewens and M. W. Lister (Trans. Faraday Soc., 1939, 35, 681—691; cf. A., 1939, I, 13).—Study of the electron diffraction of the vapours indicates that $Fe(CO)_5$ has a trigonal bipyramidal structure, whilst the hydrides show a tetrahedral arrangement of CO groups and should be formulated $Fe(CO)_2(COH)_2$ and $Co(CO)_3 \cdot COH$, respectively. The metal–C bonds, when compared with the sums of the single bond covalent radii, show shortenings similar to those found in other metal carbonyls.

F. L. U.

Crystal structure of β-FeO·OH. O. KRATKY and H. NOWOTNY (Z. Krist., 1938, **100**, 356—360; cf. A., 1936, 562; Weiser, A., 1935, 433).—From powder X-radiograms (Co $K\alpha$) confirmed by a fibre photograph, the revised rhombic cell has 8 mols. with a 10·2, b, 10·5, c 3·03 A. The difference between calc. (3·67) and observed (3·1—3·4) ρ is due to adsorbed H_2O which stabilises the β-form. Genesis and structural relations with the α- and γ-forms are discussed.
　　　　　　　　　　　　　　　　　I. McA.

Unit cell and probable space-group of strontium hydroxide octahydrate, $Sr(OH)_2,8H_2O$. D. P. MELLOR (Z. Krist., 1939, **100**, 441—442).—Natta's structure (A., 1929, 244) is incorrect. The cell has a 8·97, c 11·55 A.; 4 mols. per cell; ρ 1·885. Analysis of reflexions on Laue and oscillation X-radiograms favours the space-group D_{4h}^2—$P4/mcc$.
　　　　　　　　　　　　　　　　　I. McA.

Theoretical structural examination of the habit of sodium chlorate. W. HEINTZE (Z. Krist., 1938, **100**, 285—296; cf. Berg, A., 1938, I, 243).—The habit of $NaClO_3$ grown from solution depends on solvent, concn., and added salts. Results and views, chiefly of Buckley and of Seifert, are surveyed. The relative effects of $Na_2S_2O_6$, $NaNO_3$, Na_2SO_4, Na_2CrO_4, and $NaClO_4$ are related to the measure of agreement between the spatial and charge distribution of the ions in the terminal faces of these salts and $NaClO_3$.
　　　　　　　　　　　　　　　　　I. McA.

Crystal structure of neodymium bromate enneahydrate, $Nd(BrO_3)_3,9H_2O$. L. HELMHOLZ (J. Amer. Chem. Soc., 1939, **61**, 1544—1550).—Single crystals of $Nd(BrO_3)_3,9H_2O$ were prepared by adding hot $Ba(BrO_3)_2$ to $Nd_2(SO_4)_3$, filtering, and evaporating slowly. Chiefly they were fine, pink, hexagonal prisms, space-group C_{6v}^4—$C6mc$, 1·98 mols. per unit cell, interfacial $(10\cdot0:10\cdot1)$ angle 56° 45′, $a:c$ 1·736:1. In $Nd(OH_2)_9^{\cdots}$ the Nd ions are surrounded by 9 H_2O mols., six at the corners of a trigonal prism, at a distance $2\cdot47\pm0\cdot05$ A., and three out from the prism faces at a distance $2\cdot51\pm0\cdot05$ A., space-group approx. D_{3h}. For the BrO_3 group the following dimensions are given : Br—O $1\cdot74\pm0\cdot07$; O—O $2\cdot75\pm0\cdot10$ A.; angle OBrO $105\pm10°$. The location of H bonds is considered and vals. of different H bond angles are given. A certain degree of randomness is suggested by the intensity relationships.
　　　　　　　　　　　　　　　　　W. R. A.

Co-ordination of aluminium in andalusite. P. C. THORNELY and W. H. TAYLOR (Mem. Manchester Phil. Soc., 1939, **83**, 17—30).—A Fourier projection of the structure of andalusite (Al_2SiO_5) on the plane (001) has been carried out. It indicates the existence of the (AlO_5) group, which is linked with octahedral (AlO_6) groups and tetrahedral (SiO_4) groups. The dimensions of these structural units are also obtained.
　　　　　　　　　　　　　　　　　A. J. M.

Determination of lattice constants of triclinic crystals from one crystal setting : special case. T. ITO (Z. Krist., 1939, **100**, 437—439; cf. Buerger, A., 1937, I, 399).—Where, as frequently occurs (wollastonite group, plagioclases), one axial angle is ~90°, a simplification of Buerger's equi-inclination Weissenberg diagrams suffices. The procedure is illustrated for schizolite (from ussingite, Greenland)

C C** (A., I.)

giving : a 8·09, b 7·24, c 7·05 A., α 90°, β 95° 22′, γ 101° 56′; 2 mols. $HNa(Ca,Mn)_2Si_3O_9$ per cell; ρ ~2·90.
　　　　　　　　　　　　　　　　　I. McA.

Lattice structure of natural cellulose. H. KIESSIG (Z. physikal. Chem., 1939, **43**, B, 79—102).—A crit. consideration of existing and new data on X-ray diagrams of natural cellulose shows that no model so far advanced accounts for all the facts.
　　　　　　　　　　　　　　　　　W. R. A.

Exact determination by means of electron beams of lattice constants for different sizes of crystallite. H. BOOCHS (Ann. Physik, 1939, [v], **35**, 333—349).—The lattice plane distances in small Ni crystallites (about 16 A.) are > in large crystallites (about 30 A.). Au crystallites down to 20 A. have the same consts. as large crystals. Lattice consts. of NaCl, KCl, NaBr, and LiCl agree to $\pm1\cdot5\%$ with X-ray vals. (cf. Finch and Fordham, A., 1935, 274).
　　　　　　　　　　　　　　　　　O. D. S.

Magnetisation of pyrrhotite crystals. S. KAYA and S. MIYAHARA (Sci. Rep. Tôhoku, 1939, **27**, 450—458).—Magnetic anisotropy measurements on a perfect pyrrhotite crystal from Asio (Japan) show hexagonal symmetry.
　　　　　　　　　　　　　　　　　D. F. R.

Pleochroism of sodium nitrate crystal. B. MUKHOPADHYAY (Z. Krist., 1938, **100**, 308—315; cf. Krishnan, A., 1933, 1109).—For the λ range 2531—3346 A., measurements have been made of the absorption coeffs. for the two extinction directions on the flat (10Ī1) face of thin crystal plates. The derived principal molar absorption coeffs. are 1200, 16,000, respectively, at 2960 A., the region of max. absorption, and are also those of the NO_3' ions owing to parallel orientation. Comparison of these vals. with corresponding data for cryst. KNO_3 and aq. NO_3' solutions shows the dependence of the principal coeffs. of NO_3' on environment. Measurements of birefringence for $NaNO_3$ have been extended to 3118 A. I. McA.

Structure and optical properties of iridescent glass. (SIR) C. V. RAMAN and V. S. RAJAGOPALAN (Proc. Indian Acad. Sci., 1939, **9**, A, 371—381).—Examination of 30 photomicrographs (reproduced) of numerous specimens of decomposed glass reveals 6 distinct optical phenomena corresponding with 6 different structures. Contrary to Brewster's observation, the iridescence of decomposed glass does not disappear on immersion in a liquid; the colours actually become more vivid but the intensity is much less. Changes of colour occur with absorption of liquid. This indicates an openness of internal structure which is confirmed by observations on the polarisation of reflected light, and on the effect of mechanical pressure on the iridescence. W. R. A.

Reflectivities of evaporated metal films in the near and far ultra-violet. G. B. SABINE (Physical Rev., 1939, [ii], **55**, 1064—1069).—Reflectivities were determined photographically, and curves plotted against λ are given from the visible to 450 A. for the following metals : Al, Sb, Be, Bi, Cd, Cr, Cu, Au, Fe, Pb, Mg, Mn, Mo, Ni, Pd, Pt, Ag, Te, Ti, Zn, and Zr. For the region 5000—2400 A., a quartz Hg arc with calibrated wire screens and a quartz prism spectrograph were used, and for the region 2400—450 A., a

vac. spectrograph with grating, a discharge tube, and oiled photographic film. Accuracy is 3—5%.

N. M. B.

Variation of Young's modulus for iron at low temperatures. M. BARBARON (Compt. rend., 1939, **208**, 1559—1561).—The curve showing the variation of Y_θ/Y_0 with θ (—180° to 25°) for a 0·1-mm. Fe wire contains several inflexions and a marked anomaly at —40°; the latter corresponds with an anomaly in the thermal expansion (cf. A., 1930, 986), but no irregularity in the electrical resistance variation can be detected. A thermal hysteresis effect, resulting in an increase in Y, is observed.   A. J. E. W.

Dependence of the modulus of elasticity, elastic limit, and tensile strength of palladium on its hydrogen content. F. KRÜGER and H. JUNGNITZ (Z. tech. Physik, 1936, **17**, 302—306; Chem. Zentr., 1936, ii, 3059).—Data for Pd wires are recorded. The initial adsorption of at. H causes an increase in all three factors, which subsequently fall in proportion to the [H] as H_2 is adsorbed in the mol. form.

A. J. E. W.

State of atoms in plastically deformed metals. N. F. LASCHKO and B. G. PETRENKO (Trans. Inst. Chem. Charkov Univ., 1938, **4**, No. 13, 65—70).—Theoretical. No analogy exists between modification of the state of atoms due to temp. change or to plastic deformation.   R. T.

Magnetoresistance of nickel in large fields. C. W. HEAPS (Physical Rev., 1939, [ii], **55**, 1069—1071).—Measurements in fields up to 24,000 gauss give curves showing a drop in large fields, in agreement with Gerlach's theory that a resistance decrease $\propto$ the square of the increase of spontaneous magnetisation is produced. The const. of proportionality is dependent on the temp. It is concluded that spontaneous magnetisation may be increased by a magnetic field, even up to 200,000 gauss, without saturation appearing.   N. M. B.

Relaxation connected with the transition from the superconducting to the normal state. P. H. VAN LAER and H. J. GROENEWOLD (Physica, 1939, **6**, 473—480).—Existing experimental evidence is reviewed in support of the view that there is an essential difference between the time effects observed in magnetic properties in the transition from the superconductive to the normal states and thermal relaxation effects, and between the thermally-induced transition and that dependent on the external field. L. J. J.

Threshold and equilibrium curves for superconductors. J. G. DAUNT (Phil. Mag., 1939, [vii], **28**, 24—33; cf. A., 1936, 556; 1937, I, 541).—An investigation of the crit. magnetic fields required to disturb the superconductivity at different temp. as measured by resistance and by induction, for Pb, Sn, and Hg. The threshold vals. of Sn and Hg agreed well with previous results but marked differences were noted for Pb. With Pb tho change to zero resistance becomes more gradual as the temp. is lowered. It is suggested that this may be quite general in high magnetic fields.   T. H. G.

Diamagnetism of an electron gas. III. A. PAPAPETROU (Z. Physik, 1939, **112**, 587—604; cf.

A., 1937, I, 404, 591).—Theoretical. The χ is calc. for a rectangular parallelepiped in weak fields and a dependence is found between χ and the shape of the space. It is shown that for all practical fields an abnormally strong diamagnetism, independent of shape, is to be expected.   L. G. G.

Effect of small proportions of foreign substances on the magnetic properties of platinum. (MLLE.) R. THÉRON (Compt. rend., 1939, **208**, 1634—1636).—The $1/\chi$–θ curves for pure Pt (20° to —180°) consist of intersecting straight lines corresponding with at. moments of 8·5 (above —55°), 10·5 (—55° to —120°), and 13 μ_w (below —120°). Heat-treatment at $> 1000°$ causes parallel displacement of these lines. In presence of Mn ($<0·1\%$) or traces of C, the apparent at. moment is considerably modified by heat-treatment; with Mn the curve becomes a straight line ($8\mu_w$) down to —170°, and moments of 6, 7·3, and 9 μ_w can bo obtained with C. Addition of 2—5% of Au to pure Pt causes similar changes (moment 9 μ_w), showing that diamagnetic atoms are responsible for the effects, which account for the existence of specimens of Pt having different magnetic properties (A., 1931, 1357). The impurities may have a catalytic effect on magnetic transformations.

A. J. E. W.

Paramagnetic solutions. Comparison of the laws of thermal variation of magnetic rotatory power and of susceptibility. H. OLLIVIER (Ann. Physique, 1939, [xi], **11**, 461—503).—Investigation of the thermal variation of the sp. magnetic rotatory power G (calc. on the basis of additivity from tho measured vals. of the magnetic rotatory power of solutions) and of the susceptibility, χ, of various salts leads to the classification : (i) diamagnetic salts with a positive rotation (salts of Zn, Na, Mg), thermal variation of G is zero or insignificant like the thermal variation of χ; (ii) paramagnetic salts with a negative rotation (salts of Ce, Nd, Pr, Er, Fe·· , and alkali dichromates), thermal variation of G analogous to that of χ; (iii) paramagnetic salts with a small positive rotation (salts of Mn, Gd, Fe···), magnetic rotatory power of the cation is zero; (iv) paramagnetic salts with a positive rotation (Ni salts), cation behaves from the viewpoint of magnetic rotation as a diamagnetic ion.   W. R. A.

Magnetic properties of some salts of the iron group at low temperatures. W. J. DE HAAS and B. H. SCHULTZ (Physica, 1939, **6**, 481—496; cf. A., 1939, I, 188).—The susceptibility and remanence of the anhyd. salts $CoCl_2$, $CoBr_2$, CoF_2, and $Ti_2(SO_4)_3$, and also of $Mn(OAc)_3,2H_2O$ have been studied as a function of temp. and field-strength up to 23,000 gauss.   L. J. J.

Magnetic flux distribution when a cylinder of constant permeability is placed in a homogeneous field. Magnetic susceptibility of gadolinium oxide at low temperatures. W. F. GIAUQUE and J. W. STOUT (J. Amer. Chem. Soc., 1939, **61**, 1384—1393).—The magnetic susceptibility, χ, of a solid may be calc. from measurements of the flux of induction (a) through coils located at various positions about a cylindrical sample as well as (b) in coils surrounding an ellipsoidal sample. Measurements

have been made at low temp. $(1\cdot5 - 88° \text{K.})$ with Gd_2O_3, a paramagnetic substance of relatively high and field-independent χ. The vals. of χ obtained from (b) were used to interpret the readings obtained from (a). 　　　W. R. A.

Influence of water on the magnetic constants of the rare-earths. B. CABRERA (J. Chim. phys., 1939, **36**, 117—129).—A detailed account of work already noted (cf. A., 1939, 1, 131).　　W. R. A.

Magnetic anisotropies of some organic crystals in relation to their structures. S. BANERJEE (Z. Krist., 1938, **100**, 316—355; cf. A., 1935, 924; Lonsdale, A., 1937, I, 18).—A comprehensive and detailed review is given, with further (including X-ray) measurements. Magnetic anisotropies, principal and mean molar susceptibilities, and related crystallographic data are listed for 33 aromatic compounds selected for their fundamental structural significance and containing from 1 to 5 separate or condensed ring nuclei. Many orientations of mols. or ring planes are derived, and the results confirmed by, or discussed in relation to, mol. and cryst. structures as found by other (chiefly X-ray) methods.
　　　　　　　　　　　I. McA.

Diamagnetic susceptibilities of some non-aromatic organic crystals. K. BANERJEE and J. BHATTACHARYA (Z. Krist., 1939, **100**, 420—424).—Previous methods and technique are outlined and applied, with X-ray measurements, to the structure analysis of guanidine carbonate, $(CN_3H_6)_2CO_3$ (I), artostenone (II), and decahydro-β-naphthol (III). (I) is tetragonal, a 6·95, c 19·45 A.; 4 mols. per cell; space-group D_4^1 and D_4^8, the mol. possessing thus a 2-fold axis of symmetry. $\chi_c - \chi_a$, χ_a, χ_c are (all $\times 10^{-6}$) $1\cdot418$, $-98\cdot6$, $-97\cdot2$ e.m.u., respectively. (II) is monoclinic, a 17·25, b 10·25, c 7·45 A., β 100° 16′; 2 mols. per cell; χ_1, χ_2, χ_3 $-170\cdot85$, $-182\cdot27$, $-170\cdot99$, respectively. (III) is rhombic with χ_a, χ_b, χ_c $-34\cdot08$, $-25\cdot39$, $-42\cdot01$, respectively. To a smaller extent than in aromatic compounds, ring structure gives rise to magnetic anisotropy. Mol. orientations are sketched.　　　I. McA.

Absorption of sound in CO_2 gas, in CO_2 containing small quantities of H_2, D_2, H_2O, D_2O, and in mixtures of CO_2 and O_2. Collision efficiencies. A. VAN ITTERBEEK, P. DE BRUYN, and P. MARIËNS (Physica, 1939, **6**, 511—518).—Data are recorded for absorption of sound in highly purified CO_2 at 599 khz., for 1 atm. and temp. 18—50°. Small amounts ($<1\%$) of H_2, D_2, H_2O, and D_2O markedly increase the absorption, but with increasing proportions of O_2 a continuous decrease to the classical val. at 100% O_2 is found. For pure CO_2 the relaxation time and collision efficiency for vibrational excitation, and for the admixtures the relative collision efficiencies, are calc. The latter is zero for O_2.　　L. J. J.

Dispersion of ultrasonic velocity in liquids. K. G. KRISHNAN (Proc. Indian Acad. Sci., 1939, **9**, A, 382—385).—Measurements of the ultrasonic velocity in xylene, C_6H_6, CCl_4, CS_2 (frequencies 1·5 to 7 mc.), and H_2O (frequencies 1·5 to 22·5 mc.) reveal no definite evidence of acoustic dispersion.
　　　　　　　　　　　W. R. A.

Frequency change of light in diffraction by ultrasonic waves. F. LEVI (Helv. Phys. Acta, 1936, **9**, 234—244; Chem. Zentr., 1936, ii, 932).—Raman and Nath's theory (A., 1936, 555) is generalised and extended to give the ν change in a wave-train or in standing waves. The results are compared with experimental data (Bär, A., 1937, I, 174; Ali, A., 1938, I, 129).　　A. J. E. W.

Fusion of graphite under pressures of argon of from 1 to 11,500 kg. per sq. cm. Determination of the triple point and the construction of a provisional diagram for the solid, liquid, and gaseous states of carbon. J. BASSETT (J. Phys. Radium, 1939, [vii], **10**, 217—228).—The fusion of graphite under various pressures of A (1 to 11,500 kg. per sq. cm.) has been investigated by means of an apparatus which is described. The triple point co-ordinates are 105 kg. per sq. cm. and 4000° K. No conclusive data on the variation of the temp. of fusion with pressure have been obtained. Graphite, melted under 4000 kg. per sq. cm., has d 2·25 and crystallises on cooling, under this pressure and at pressures up to 11,500 kg. per sq. cm., in the form of graphite. A provisional diagram for the three states of C is put forward and discrepancies between the temp. of C in an electric arc and the measured temp. of sublimation are discussed.　　W. R. A.

True specific heat [of platinum and] of nickel above the Curie point. B. PERSOZ (Compt. rend., 1939, **208**, 1632—1634; cf. B., 1939, 618).—For Pt at 0—1000°, $c_p = 0\cdot0312 + (6\cdot29 \times 10^{-6})\theta$; for Ni at 400—1000°, $c_p = 0\cdot119 + (29\cdot2 \times 10^{-6})\theta$.
　　　　　　　　　　　A. J. E. W.

Internal rotation in dimethylacetylene. B. L. CRAWFORD, jun. and W. W. RICE (J. Chem. Physics, 1939, **7**, 437).—Comparison of calc. and observed heat capacities of gaseous $(CMe:)_2$ indicates that free internal rotation of the Me groups against each other occurs with a restricting potential barrier of <500 g.-cal. per mol. From unpublished Raman and infra-red data vals. of C_p^0, the heat capacity of the ideal gas (exclusive of the contribution from internal rotation), have been obtained. The heat capacity of the gas has been measured at 336° and 369° K. by the adiabatic expansion method (A., 1939, I, 362) and corr. to C_p^0.　　W. R. A.

Analogues of entropy. T. H. HAZLEHURST (J. Physical Chem., 1939, **43**, 759—765).—Entropy and temp. have properties analogous to other extensive and intensive energy factors respectively.
　　　　　　　　　　　W. R. A.

Thermodynamical properties of some super-conductors. J. G. DAUNT, A. HORSEMAN, and K. MENDELSSOHN (Phil. Mag., 1939, [vii], **27**, 754—764).—The equilibrium curves of Tl and In have been determined between 1° K. and the transition point, and previous measurements on Sn and Pb (A., 1937, I, 451) have been supplemented. The differences in entropy and sp. heat between the normal and superconductive states for the four metals have been evaluated, and the sp. heat of the system of superconductive electrons has been determined. For Sn the vals. of the sp. heat derived from the equilibrium

curve agree with the vals. obtained by direct calori-metric measurements. It is concluded that all free electrons are in the superconductive state at 0° K., and the sp. heat of the system of superconductive electrons is interpreted to indicate a decrease in the no. of these electrons with temp.　　W. R. A.

Persistence of liquid structure in the critical region. J. DACEY, R. MCINTOSH, and O. MAASS (Canad. J. Res., 1939, 17, B, 145).—When a mixture of C_2H_4 liquid and vapour is heated just above the crit. temp. T_c (as defined by disappearance of a meniscus) a heterogeneity presists until it is removed by "mol. stirring," heating to 5° above T_c and cooling again, or by isothermal expansion. When the upper portion of the tube only is superheated, however, a heterogeneity in the lower portion persists even after the upper portion is cooled to the original temp. It therefore appears possible to produce dense and less dense media in equilibrium with one another above T_c.　　J. W. S.

Phase equilibria in hydrocarbon systems. Latent heat of vaporisation of propane and n-pentane. B. H. SAGE, H. D. EVANS, and W. N. LACEY (Ind. Eng. Chem., 1939, 31, 763—767).—The latent heats of evaporation (L) of C_3H_8 and n-C_5H_{12} have been determined at 100—170° F. and 80—200° F., respectively. The changes of L with temp. are in accord with the theoretical vals. deduced from the isobaric heat capacity and the isothermal pressure coeff. of the enthalpy for the saturated liquid and vapour.　　J. W. S.

Specific heats and heats of fusion and transition of carbon tetrabromide. K. J. FREDERICK and J. H. HILDEBRAND (J. Amer. Chem. Soc., 1939, 61, 1555—1558).—CBr_4 (m.p. 90·1°, transition point 46·9°), by the method of mixtures, gives: heat of fusion at m.p., 945±25; heat of transition, 1420±15; molal heat capacity from 25° to 46·9°, 35·0±0·5; from 46·9° to 90·1°, 42·9±0·3; from 90·1° to 150°, 36·7±0·5 g.-cal. per mol.　　W. R. A.

Densities of liquid organic compounds. A. RAMAT (Bull. Soc. chim., 1939, [v], 6, 957—963).—From measurements of d^0 for various org. compounds the following mol. vol. contributions of radicals have been deduced: C ~0, CH 3·8, CH_2 16·3, Me 30, Ph 73·7, N ~0, NH 6·5, NH_2 17, NO_2 ~23, O 7, OH 10·5, Cl 23, Br 26·5, I 33, CO 11, CO_2 25, CO_2H 27·5, CHO 25, and CN 20 c.c., respectively. The group mol. vol. relationship is more closely followed than the at. vol. law of Kopp and is not restricted to vals. measured at the b.p.　　J. W. S.

Theory of liquid structure. E. P. IRANY (J. Amer. Chem. Soc., 1939, 61, 1436—1443).—Liquids are assumed to be systems of two phases in equili-brium; one of these consists of a two-dimensional mol. lattice structure, whilst the other occupies the remain-ing space and is in a gaseous condition. Equilibrium depends on temp. but not on the external pressure. An equation of the liquid state involving P, V, T, γ, and η has been developed and holds for a large no. of pure liquids and mixtures.　　W. R. A.

Vapour pressure of o- and p-H_2 and D_2. K. COHEN and H. C. UREY (J. Chem. Physics, 1939, 7, 438).—Mathematical. (Cf. A., 1939, I, 248.)　　W. R. A.

Mol. wt. and vapour pressure of selenium. K. NEUMANN and E. LICHTENBERG (Z. physikal. Chem., 1939, 184, 89—99).—The average val. for the mol. wt. of Se vapour at 200° is 476, indicating a degree of association corresponding with Se_6. V.p. data for solid and liquid Se have been obtained and used to calculate the heats of vaporisation of solid and liquid Se, viz., 33·92 and 24·58 kg.-cal. per mol. respectively, and the heat of fusion, viz., 9·34 kg.-cal. per mol.　　C. R. H.

Thermodynamic properties of methyl chloride. H. G. TANNER, A. F. BENNING, and W. F. MATHEW-SON (Ind. Eng. Chem., 1939, 31, 878—883).—Tables serviceable to refrigeration engineers have been com-puted from published data by equations relating the various thermodynamic properties. V.p. for the range —80° to 170° F., sp. vol., heat content, and entropy of the saturated vapour from —40° to 170° F., and of superheated vapour at pressures of 6—200 lb. per sq. in. are given. (Misprints occur in the last 8 vals. for sp. vol. of saturated vapour.)　　F. L. U.

Thermodynamic properties of chlorofluoro-methanes and -ethanes. A. F. BENNING and R. C. MCHARNESS (Ind. Eng. Chem., 1939, 31, 912—916).—Measurements of v.p., ρ, and heat capacity of liquid and vapour, and C_p/C_v for the vapour, for $CHClF_2$, $CHCl_2F$, CCl_3F, and $CCl_2F \cdot CClF_2$ are re-corded.　　F. L. U.

Second virial coefficient of helium gas for the lowest measured temperature. L. GROPPER (Physical Rev., 1939, [ii], 55, 1095—1097; cf. A., 1937, I, 453).—Calculations analogous to those of Massey and Buckingham with the Slater–Kirkwood potential (cf. A., 1939, I, 135) are made with the Slater–Margenau potential. Results indicate that the real potential must lie somewhere between these two.　　N. M. B.

Problem in heat conduction. H. W. WOOLLEY (Phil. Mag., 1939, [vii], 27, 706—708).—Mathematical.　　W. R. A.

Joule–Thomson inversion curves of recent equations of state. J. CORNER (Trans. Faraday Soc., 1939, 35, 784—791).—Inversion curves com-puted for the equation of state of Lennard-Jones and Devonshire (A., 1938, I, 130) are in fair agreement with experimental results at high but not at low ρ. The equation of de Boer and Michels (A., 1939, I, 248) gives fair agreement at low ρ. The latter equation gives better vals. for P_c and V_c than does the former, but not so good for T_c.　　F. L. U.

Surface transport in liquid helium II. J. G. DAUNT and K. MENDELSSOHN (Nature, 1939, 143, 719—720; cf. A., 1938, I, 566).—Experiments which show that a transfer of He II from a colder to a hotter place occurs when a temp. gradient is imposed, and that the flow of liquid He II through a plug of powdered emery is accompanied by a caloric effect, are described. They support the view that the trans-

port phenomena in liquid He II are due mainly to surface flow. L. S. T.

Internal friction of gases. I, II. S. WEBER (Physica, 1939, **6**, 551—561, 562—571).—I. The viscosity–pressure relation found by van Itterbeek and Keesom (A., 1938, I, 304) for He at low temp. is deduced theoretically.

II. A general viscosity–temp. relation valid for a no. of mono- and di-at. gases, but not for He and H_2, is deduced. L. J. J.

Viscosity of compounds and the limiting volume of sulphur. G. P. LUTSCHINSKI (J. Phys. Chem. Russ., 1938, **12**, 280—285).—Vals. are recorded for η of SO_2 between —40° and 0°, of SO_3 between 15° and 40°, of SCl_2 between 0° and 15°, of S_2Cl_2 between —15° and 100°, of $SOCl_2$ between —15° and 60°, of SO_2Cl_2 between —10° and 60°, of $S_2O_5Cl_2$ between 0° and 90°, and of $S_3O_7Cl_4$ between 10° and 40°. All the vals. agree with Batschinski's equation. Assuming the additivity of the at. limiting vols. the limiting vol. of S becomes 15·7 c.c.; it agrees with the vol. calc. from the η of free S between 120° and 155°.
J. J. B.

Viscosity of liquids. A. H. NISSAN and L. V. W. CLARK (Nature, 1939, **143**, 722—723).—When log η of the n-paraffins from $n\text{-}C_4H_{10}$ to $n\text{-}C_{18}H_{38}$ is plotted against $T_{b.p.}/T$ a smooth curve is obtained, showing that a sp. viscosity curve is given by a homologous series provided that the first few members are excluded. In the formula $\eta = Ae^{B/T}$, B is not invariant with temp. as is generally assumed. Examination of 137 liquids shows that they can be classified into (i) unassociated liquids and liquids which do not change their degree of association with temp., (ii) associated liquids, and (iii) metallic liquids. L. S. T.

Plastic–elastic state. K. BENNEWITZ and H. RÖTGER (Physikal. Z., 1939, **40**, 416—428).—Theoretical. A. J. M.

Representation of the viscosity of binary gas mixtures by the gas-kinetic mixture formula. E. SCHRÖER (Z. physikal. Chem., 1939, **43**, B, 103—108).—For the mixtures $H_2\text{-}CH_4$, $H_2\text{-}C_2H_6$, $H_2\text{-}C_2H_2$, $H_2\text{-}C_3H_6$, $CH_4\text{-}C_2H_2$, $C_2H_2\text{-}C_3H_6$, and $C_3H_8\text{-}C_3H_6$ ($C_3H_6 = CHMe{:}CH_2$) vals. of η calc. by Sutherland's mixture equation (cf. A., 1937, I, 72) do not agree with the experimental vals. of Adzumi (cf. ibid., 405), due probably to impurities in the gases used. W. R. A.

Influence of solvents and of other factors on the rotation of optically active compounds. XXXVII. Asymmetric solvent action (continued). T. S. PATTERSON, A. H. LAMBERTON, and R. M. CUNNINGHAM (J.C.S., 1939, 962—967; cf. A., 1937, I, 513).—The effect of admixture on the rotation of nicotine has been studied for Et d-, dl-, and i-tartrates and Bu$^\beta$ d-, l-, dl-, and i-tartrates. The observed rotations of the mixtures compare unfavourably with the rotations calc. on the basis of additivity, except for the nicotine–Bu$^\beta$ dl-tartrate mixture. The discrepancies are due to a mutual solvent effect, each component of the mixture affecting the rotation of the other. Bu$^\beta$ i-tartrate, prepared by the Fischer–Speier method, has m.p. 81—82°, b.p. 176—178°/12 mm., ρ_4^{100} 1·0216 (molten state). W. R. A.

Viscosity of aqueous solutions of strong electrolytes. V. Viscosity of aqueous solutions of cerite earth nitrates as an indication of their basicity. H. TOLLERT (Z. physikal. Chem., 1939, **184**, 165—178).—Data are recorded for η and ρ of solutions of $La(NO_3)_3$, $Ce(NO_3)_3$, $Ce(SO_4)_2$, $Pr(NO_3)_3$, $Nd(NO_3)_3$, and $Sm(NO_3)_3$ alone, and in presence of the corresponding acid with const. acid/salt ratio, and also for the acids alone. In presence of HNO_3 η at low concns. is <, and at high concns. is >, when HNO_3 is absent. This behaviour is attributed to repression of hydrolysis in presence of HNO_3. Calculations of the degrees of hydrolysis have been made on the basis of the author's theory (cf. A., 1935, 443) from data for the sp. η of the various ions. The similarity between the plots of sp. η and reduction potential against the at. nos. of the earths is discussed. C. R. H.

Viscosity of the liquid phase of frozen solutions of the sea-water type. D. M. KORF and N. A. ZACHAROVA (J. Appl. Chem. Russ., 1939, **12**, 234—237).—The η of sea-H_2O between —10° and 20° is expressed by $\eta = \eta_0(1 + a\theta + b\theta^2)$, where η_0 is the η at 0°, θ is the temp., and a and b are consts.
R. T.

Aqueous solutions of electrolytes. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], **6**, 963—970).—The mol. heat of dilution, fraction of undissociated mols., variation in viscosity, and apparent vol. of dilute electrolyte solutions of concn. c can be expressed by the general relation $Y = p\Delta/(1 + q\Delta)$, where p and q are consts. dependent on the temp. and the electrolyte concerned, and $\Delta = \Lambda_0 - \Lambda_c$. For strong electrolytes of low and medium concn. this relation can be expressed $Y = p_2\sqrt{c}/(1 + q_2\sqrt{c})$. J. W. S.

Micro-crystallisation studies with supersaturated solutions. A. TSCHERMAK-SEYSENEGG (Mikrochem., 1939, **27**, 96—111).—Supersaturated solutions or melts of NaOAc, KOAc, $Na_2S_2O_3$, salol, K alum, and K Cr alum can be preserved indefinitely in absence of sp. nuclei. The immunity persists in presence of non-isomorphous crystals of other hydrates of the same substance. The seeding test is applicable as a micro-method for determining the coincidence or otherwise of space-lattice and crystal structure. A local cooling method is developed for seeding solutions in sealed tubes. Evolution of heat, but not of radiant energy, has been detected during crystallisation. The cause of the electrical charge production during crystallisation is discussed.
J. W. S.

Phase relations and magnetic behaviour in the system titanium–oxygen. P. EHRLICH (Z. Elektrochem., 1939, **45**, 362—370).—Oxides of composition between TiO_2 and $TiO_{0.58}$ have been prepared by heating mixtures of TiO_2 and Ti, and examined by X-rays. Four different lattice structures are observed, the α-, β-, γ- and δ-phases occurring over the composition ranges $TiO_{2.00}$—$TiO_{1.90}$, $TiO_{1.80}$—$TiO_{1.65}$, $TiO_{1.56}$—$TiO_{1.46}$, and $TiO_{1.25}$—$TiO_{0.6}$. The β-phase may be a distorted α-phase. At the composition $TiO_{1.00}$ 15% of the lattice positions in the δ-phase are unoccupied. An increase in the no. of Ti positions occupied, however, is always accompanied by a decrease in the no. of O positions, and vice versa, until

at extreme compositions at which this phase is stable all the positions of one element are occupied. The magnetic properties indicate that Ti''' and Ti'' ions form interat. linkings with one another, excepting at very high [Ti''''].   J. W. S.

Mixed oxide phases with an incomplete oxygen lattice. L. G. SILLÉN and B. AURIVILLIUS (Naturwiss., 1939, **27**, 388—389).—In the systems PbO–Bi_2O_3 and SrO–Bi_2O_3 phases have been found in which, with varying composition, the no. of metal atoms in the lattice remains const., but the no. of O atoms is variable. In the PbO–Bi_2O_3 system a homogeneous tetragonal phase was found with 40—68 at.-% Bi, the unit cell containing 2 metal atoms and 2·4—2·7 O. In the SrO–Bi_2O_3 system a rhombohedral phase was found with 80—85 at.-% Bi, with 3 metal atoms and 4·2—4·3 O in the unit cell.   A. J. M.

Structure of solid solutions. J. A. WASASTJERNA (Physical Rev., 1939, [ii], **55**, 986—987).—X-Ray investigations indicate that in the case of a mixed crystal (KCl + KBr) the actual mean distances of the ions from the theoretical positions in a face-centred lattice cannot be entirely explained by thermal vibrations; hence the actual positions of equilibrium of the ions do not agree with the theoretical lattice points. An explanation is discussed in detail.   N. M. B.

Magnetochemistry of mixed crystals. N. PERAKIS and L. CAPATOS (J. Phys. Radium, 1939, [vii], **10**, 234—240).—An extension and summary of work already noted (A., 1936, 786; 1938, I, 187).   W. R. A.

Physico-chemical investigations on the fine structure of glasses. III. Binary and pseudo-binary glasses with insignificant packing effects. E. KORDES (Z. physikal. Chem., 1939, **43**, B, 173—190).—n, d, mol. vol., and mol. refractivity ([R]) data for glasses of the systems B_2O_3–As_2O_3 and piperine–phenolphthalein indicate that these properties are almost strictly additive. On the other hand, in the system B_2O_3–Sb_2O_3 only the mol. refractivity is strictly additive, the mol. vol. being slightly < and n and d being > calc. vals. assuming additivity, max. variation occurring with an equimol. mixture. Strict additivity of mol. vol. is shown with piperine–SbI_3 systems, but [R] is > and n and d are < calc. vals.   C. R. H.

Molecular refraction of glasses. (A) E. KORDES. (B) W. BILTZ and F. WEIBKE (Z. anorg. Chem., 1939, **241**, 418—420, 421—423).—Polemical (cf. Biltz and Weibke, A., 1939, I, 250).   F. J. G.

Tempering of borate-soda glasses. M. FOËX (Bull. Soc. chim., 1939, [v], **6**, 1056—1061; cf. A., 1939, I, 137).—Tempered and annealed $Na_2O,3B_2O_3$ glasses both show only diffuse X-ray diffraction patterns, but devitrified glass shows a distinct line structure. This evidence supports the view that there is a distinct line of demarcation between the vitreous and cryst. states.   J. W. S.

Structure of magnesium-strontium alloys. H. VOSSKÜHLER (Metallwirts., 1939, **18**, 377—378).—Thermal analysis and micrographical examination of the alloys reveals the existence of a compound Mg_9Sr,

m.p. 606°; this compound forms a eutectic with Mg at 582°, 18·4% Sr and with a Sr-rich phase at 592°, 39·8% Sr. The system is therefore analogous to the Mg–Ba system.   A. R. P.

Conversion velocity of supersaturated solid solutions of magnesium–aluminium. I. I. KORNILOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 172—175).—The pptn. of the excess phase from supersaturated solid solutions containing 11·9% of Al has been studied at 100—350° by means of microstructure and hardness determinations. At temp. >300° the excess phase ppts. without perceptible ageing, at approx. 100—300° pptn. occurs with ageing, and at 100° the alloy shows no appreciable change during the time of observation. The change in microstructure shows that the conversion process begins at the grain boundaries and develops towards the interior of the grain.   E. S. H.

Thermal and electrical conductivities of some magnesium alloys. R. W. POWELL (Phil. Mag., 1939, [vii], **27**, 677—686).—The thermal (K) and electrical (σ) conductivities of 8 alloys of Mg with Ce, Ni, Mn, Ca, and Co are recorded for 50°, 150°, and 250°. The data can be represented to within 3·5% by $K = 0.526 \times 10^{-8}\sigma T + 0.027$, where K is in g.-cal. per sq. cm. per sec. for 1 cm. thickness and 1° difference of temp., and σ in reciprocal ohms per c.c., and T in °K. Analysis of recorded data on Mg and Mg alloys leads to the general approx. equation $K = 0.516 \times 10^{-8}\sigma T + 0.022$.   W. R. A.

Evidence for a superlattice in the nickel–iron alloy, Ni_3Fe. P. LEECH and C. SYKES (Phil. Mag., 1939, [vii], **27**, 742—753).—An alloy containing 24·91% Fe, 75·04% Ni, and <0·02% Al was used. The sp. heat, after quenching in H_2O from 700°, rises slowly to 380°, falls to a min. at 425°, and subsequently rises, passing through two max. at 525° and 590°. The max. at 590° corresponds with the Curie point; the min. results from the partial ordering of the quenched disordered alloy and at 525° the alloy returns to the disordered state. On cooling 1° per min. from 650° the sp. heat curve again shows two max. but no min., presumably because ordering has set in during cooling. When the alloy is cooled slowly from 490° to 370° in 150 hr. the max. at 525° is very high, indicating greater ordering, whilst the Curie point is not appreciably changed. Curves of magnetic saturation intensity against temp. are not affected by annealing, and hence the energy of the magnetic transformation is independent of the degree of order of the material. Whereas specimens quenched from 700° showed no superlattice lines, specimens annealed for 500 hr. from 490° to 370° showed these lines in correct no. and position. Previous attempts to adduce evidence for a superlattice are reviewed and ascertained data on Ni_3Fe are compared with those for other order–disorder transformations.   W. R. A.

Structure of the ternary silver–copper-palladium system in the solid state. F. GLANDER (Metallwirts., 1939, **18**, 337—341; 357—362).—Micrographical examination and resistivity measurements show that the region of incomplete miscibility along the Cu–Ag side of the ternary diagram extends

to Ag 25, Cu 50, Pd 25 at.-% at 870°, and to Ag 25, Cu 15, Pd 60 at.-% at 400°. The isothermals run very close to the Pd-Ag side at the lower temp., indicating that Pd–Ag solid solutions decompose at low temp. Addition of small amounts of Ag to Cu–Pd alloys displaces the CuPd and Cu_3Pd transformations to slightly higher Pd contents. The ternary alloys are capable of pptn.-hardening over a wide range of composition. A. R. P.

Magnesium corner of the magnesium–silver–thallium system. W. Köster and K. Kam (Z. Metallk., 1939, **31**, 84).—The solubility of Ag in Mg is reduced from 10% to about 4·5% by addition of 30% of Tl. The hardness of Ag–Mg alloys is increased slightly and the corrosion in tap-H_2O considerably by addition of Tl, which also reduces the eutectic point progressively. A. R. P.

$Mg–MgZn_2–Mg_5Tl_2$ region of the magnesium–zinc–thallium system. W. Köster and K. Kam (Z. Metallk., 1939, **31**, 82—84).—$MgZn_2$ and Mg_5Tl_2 form a simple eutectiferous series with the eutectic at 360°, Mg 22, Zn 5, Tl 73%. The ternary system of these compounds with Mg has a ternary eutectic at 342°, Mg 25, Zn 4, Tl 71%. Tl additions increase the age-hardening of Zn–Mg alloys but decrease the resistance to corrosion. Addition of Zn to Tl–Mg alloys, on the other hand, increases their resistance to salt H_2O. A. R. P.

$Mg–MgZn–Mg_3Bi_2$ section of the magnesium–zinc–bismuth system. E. Scheil and B. Glauner (Z. Metallk., 1939, **31**, 80—81).—Zn–Bi alloys are rendered homogeneous in the liquid state by addition of >20% of Mg. In the $Mg–MgZn–Mg_3Bi_2$ section the reaction liquid $A \rightleftharpoons$ liquid $B + \beta$-Mg_3Bi_2 occurs at 750°, 45—80% Bi, and the reaction β-$Mg_3Bi_2 \rightleftharpoons$ α-$Mg_3Bi_2 +$ liquid at 677°, 20—82% Bi; the ternary eutectic point is at 339° and is almost coincident with the binary $Mg–MgZn$ eutectic point at 340°. Bi additions do not affect the hardness of Mg–Zn alloys. A. R. P.

$Mg–Mg_3Al_2–Mg_3Bi_2$ section of the magnesium–aluminium–bismuth system. E. Scheil and B. Glauner (Z. Metallk., 1939, **31**, 76—79).—Molten alloys of Mg, Al, and Bi are homogeneous when the Mg is >42%. In the pseudobinary section Mg_3Al_2–Mg_3Bi_2 alloys with 30—75% Bi form two liquid phases from which β-Mg_3Bi_2 separates at 710°; at 686° this reverts to the α-form and at 453° the remaining liquid solidifies as a eutectic with 5% Bi. The ternary system contains a eutectic at 435°, Mg 88, Al 10, Bi 2%. Bi does not affect the hardness or ageing properties of Mg–Al alloys. A. R. P.

Solubility of calcium carbonate in solutions of ammonium salts. G. Emschwiller and G. Charlot (Bull. Soc. chim., 1939, [v], **6**, 1088—1100).—Previous theories are discussed and relationships are developed expressing the variation of the solubility of $CaCO_3$ with concn. of NH_4 salt and with p_H. Measurements of the solubility of $CaCO_3$ in very dil. HCl and in aq. NH_4Cl are in accord with the theory, and indicate that the increased solubility in presence of NH_4 salts is due mainly to hydrolysis and only to a much smaller extent to salt effect. J. W. S.

Dissolution of orthotitanic acid in hydrogen peroxide. S. Katzoff and R. Roseman (Compt. rend., 1939, **208**, 1733—1734).—Co-pptd. mixtures of $Fe(OH)_3$ and $Ti(OH)_4$ are sol. in H_2O_2, although $Fe(OH)_3$ is insol.; the solutions closely resemble similar solutions of $Ti(OH)_4$ (cf. A., 1935, 1073). Dissolution is inhibited by $Ca^{..}$ or $Mg^{..}$, and facilitated by traces of alkali. A. J. E. W.

Solubility of sucrose.—See B., 1939, 765.

(A and B) Distribution of trichloroacetic acid between water and mixed organic solvents. L. M. Andreasov. **(C) Distribution of chloroacetic acids between contiguous liquid phases.** L. M. Andreasov and O. T. Davidova (Trans. Inst. Chem. Charkov Univ., 1938, **4**, No. 13, 107—120, 121—130, 131—136).—(A) The partition coeff. D of $CCl_3\cdot CO_2H$ in the systems H_2O–C_6H_6–org. solvent, at 25° and 35°, falls rapidly with rising concn. of solvent in the cases of $PhNO_2$ and iso-$C_5H_{11}\cdot OH$, and very gradually in that of $CHCl_3$. For C_6H_6–CCl_4 mixtures the val. of D rises with increasing $[CCl_4]$.

(B) The effect of addition of esters ($C_5H_{11}\cdot OAc$, MeOBz, EtOBz) is similar to that of $PhNO_2$ or $C_5H_{11}\cdot OH$, whilst PhBr acts similarly to CCl_4.

(c) Increase in the $PhNO_2$ content of the systems $CH_2Cl\cdot CO_2H$– or $CHCl_2\cdot CO_2H$–H_2O–C_6H_6–$PhNO_2$ causes a fall in the val. of D. R. T.

Influence of temperature on the partition coefficient of saturated monocarboxylic acids between water and organic solvents. A. Bekturov (J. Gen. Chem. Russ., 1939, **9**, 419—428).—The partition coeffs. D have been determined for HCO_2H or AcOH between H_2O and C_6H_6, CCl_4, or $CHCl_3$, at 0—60°. The vals. of D on the whole fall with rising temp., to a greater extent for low than for high concns. of acids. R. T.

Distribution of Br′ in the system carnallite–water. S. K. Tschirkov and M. S. Schnee (J. Appl. Chem. Russ., 1939, **12**, 209—219).—The [Br′] of the solid phases of the systems $Mg^{..}$–Cl′–Br′–H_2O (35°), $Mg^{..}$–K′–Cl′–Br′–H_2O (35° and 45°), and $Mg^{..}$–Na′–Cl′–Br′–H_2O (35°) rises with increasing velocity of crystallisation. The distribution coeff. of Br between $MgCl_2$ and its saturated solution is unaffected by dissolution of NaCl or KCl in the solution. R. T.

Distribution of I′ between the solid and liquid phases during crystallisation of potassium and sodium bromide and potassium chloride. S. K. Tschirkov and M. S. Schnee (J. Appl. Chem. Russ., 1939, **12**, 220—225).—During isothermic evaporation at 25° of solutions of KBr or KCl containing small amounts of KI, or of NaBr with NaI, the rate of increase of the [I] of the crystal is < of the dissolved salts. R. T.

Measurement of absorption of hydrogen by wires of platinum alloys. I. E. Adadurov and N. I. Pevni (J. Phys. Chem. Russ., 1938, **12**, 451—454).—The wire is enclosed in a tube containing H_2 under a known low pressure, and after sorption on the heated wire has occurred an electric discharge is passed through the residual gas, the pressure of which is deduced from the no. of striations in the discharge.

The results show that the loss of Pt in the contact oxidation of NH_3 is $\propto$ the amount of H_2 sorbed. R. C.

Active substances. XXXVIII. Study of active substances by Hahn's emanation method. R. FRICKE and H. J. BÜCKMANN (Ber., 1939, **72**, [B], 1199—1206).—The increase of emanating power (E) of active substances containing radio-Th during H_2O adsorption, reported by Mumbrauer (A., 1937, I, 408), is confirmed. Active MgO first adsorbs, then combines with, H_2O, as shown by the initial increase and subsequent decrease of E. Compression of γ-Fe_2O_3 causes a decrease of E, and the strongly compressed material shows a decrease of E during H_2O adsorption, ascribed to the failure of H_2O to loosen the secondary structure under these conditions. CuO quenched from 600—900° to 0° has an E slightly $<$ that of material cooled slowly, but adsorbs H_2O more strongly with a correspondingly greater rise in E. F. L. U.

Heat content of water adsorbed on cellulose.—See B., 1939, 700.

Variation of the triple point under pressure and by adsorption. E. LEDOUX (Chim. et Ind., 1939, **41**, 1043—1050).—Theoretical. Since adsorbed liquid is under compression (equiv. to air pressure π) owing to the adsorption forces, the triple point θ_3 lies at the point of intersection of the normal sublimation curve (the solid being unacted on by adsorption forces) and the vaporisation curve A of the liquid under an air pressure π. A is calc. for H_2O at $\pi = 250$ and 1000 kg. per sq. cm., the corresponding θ_3 being at $\sim -20°$ and $-80°$. F. J. G.

Elementary composition and sorptive properties of oxidised sugar charcoals. M. DUBININ and E. ZAVERINA (J. Phys. Chem. Russ., 1938, **12**, 380—396).—The reaction with atm. O_2 at 200—1000° of active and inactive sugar C has been studied. Examination of the sorptive power of the C for NaOH showed that the acid substance formed in the reaction with atm. O_2 at 200—600° is a surface oxide, not a separate phase, and has the properties of a weak acid. Two activation temp. optima in respect of the power of adsorbing PhOH and I_2 from aq. solution were found. R. C.

Representation and interpretation of results relating to the adsorption by carbon of different classes of organic compounds, in aqueous solution. R. AMIOT (Compt. rend., 1939, **208**, 1575—1577).—The Chakravarti–Dhar equation (A., 1928, 120) is applied to the adsorption of org. compounds by animal C. For monohydric alcohols, $m = 1$, $n/\gamma = 0.16$; n is probably 1, each alcohol mol. being adsorbed by its terminal Me group on one active adsorbent mol. k increases rapidly with the no. of C (EtOH 0.0028, $Bu^a OH$ 0.0720). With polyhydric alcohols, n and k increase with the complexity of the mol. The formula does not apply accurately to acids owing to dissociation, but the γ vals., representing the limiting vals. of s for infinite concn. of solute, approximate to those for the analogous alcohols. With phenols, n increases with complexity, but k remains approx. const. (0.87—0.89). A. J. E. W.

Electrolyte adsorption and activity coefficient. II. Adsorption of acids by carbon from mixtures of water and organic liquids. W. OSTWALD (Kolloid-Z., 1939, **87**, 284—296).—The relation $f_x = af_{c-x} + b$, previously found to hold for the adsorption of strong aq. acids on C (cf. A., 1939, I, 366), is also valid for the adsorption of HCl and picric acid from mixtures of H_2O with MeOH, EtOH, and $COMe_2$ of varying composition. The relation is no longer linear for weak acids such as AcOH. The decrease in adsorption that accompanies lowering of the ϵ of the solution is attributed to increased interionic attraction which, by strengthening the statistical kinetic ion-lattice, would oppose the redistribution of ions by adsorption. F. L. U.

Changes in sorptive properties of activated carbons with time. E. ZAVERINA and M. DUBININ (J. Phys. Chem. Russ., 1938, **12**, 397—407).—Activated C stored for 5—10 years in closed vessels was examined. C activated at 500—850° had acquired an enhanced adsorptive power for NaOH, supposedly due to formation of surface acid oxide. The adsorptive power for I_2 from aq. solution of C activated at 300—500° had not changed, whilst that of C activated at higher temp. had fallen somewhat; McBain and Sessions' results (A., 1936, 809) could not be confirmed. The adsorptive power for acids in aq. solution had fallen, but that for C_6H_6 vapour was unchanged. R. C.

Adsorption on polycrystalline bodies. E. A. NIKIFOROV (J. Phys. Chem. Russ., 1938, **12**, 468—476).—The adsorption of salts from aq. solution on polycryst. quartz is hindered or prevented by the formation on the surface of the quartz of an adsorbed layer of H_2O dipoles. Adsorption from molten salt hydrates is much more rapid than from aq. solution, suggesting that quartz adsorbs mols., not ions. The rate of adsorption increases linearly with the salt concn. R. C.

Kinetic–radioactive investigations on the active surface of crystalline powders. II. L. IMRE (Trans. Faraday Soc., 1939, **35**, 751—758).—Measurements of the adsorption of $Pb^{..}$ on the one hand and of the rate of incorporation of Th-B on the other (cf. A., 1937, I, 299) lead to discrepant vals. of the " active " portion of the surface in the case of $PbSO_4$ suspended in 22.7% aq. EtOH. Evidence is presented for the view that in the Th-B experiments the Paneth exchange process does not occur, and that the data represent recrystallisation only. On this basis the discrepancy is resolved and fair agreement between the two methods obtained. F. L. U.

Adsorption of acids by synthetic resins. G. BROUGHTON and Y. N. LEE (J. Physical Chem., 1939, **43**, 737—741).—The rates of adsorption of H_2SO_4 and HCl by NH_2Ph– and by m-$C_6H_4(NH_2)_2$–CH_2O resins have been measured. Adsorption appears to be chemical in character and the small vals. for the equilibrium adsorption suggests that condensation occurs through NH_2 groups as well as through the nucleus. W. R. A.

Sorption of water by gelatin. I. PUTILOVA (J. Phys. Chem. Russ., 1938, **12**, 286—290).—Sorption of

H_2O from its mixtures with C_6H_6, Et_2O, and $COMe_2$, and sorption of $COMe_2$ from its mixtures with C_6H_6, were determined. The sorption of C_6H_6 and Et_2O is immeasurably small. J. J. B.

Ageing and co-precipitation. XXVIII. Adsorption of bivalent ions on and co-precipitation with orthoferric hydroxide in ammoniacal medium. I. M. KOLTHOFF and L. C. OVERHOLSER (J. Physical Chem., 1939, **43**, 767—780).—The influence of temp., temp. of formation of ortho-$Fe(OH)_3$ (I), and concn. of NH_3 and of NH_4Cl on the adsorption of $Mg^{..}$, $Ca^{..}$, $Co^{..}$, $Ni^{..}$, $Mn^{..}$, and $Zn^{..}$ on (I) and on their co-pptn. with it has been studied (cf. A., 1937, I, 457). The Freundlich adsorption isotherm is obeyed for $Zn^{..}$ and $Ni^{..}$, $Zn^{..}$ being adsorbed as the aquo-ion. W. R. A.

Nature of sliding friction. J. J. BIKERMAN and E. K. RIDEAL (Phil. Mag., 1939, [vii], **27**, 687—692).—Experimental data are given which indicate that as long as Amonton's law is valid, sliding friction is due not to cohesion but to the elevation of the slider over the roughnesses in the surface as Coulomb suggested. W. R. A.

Influence of films of surface-active substances on the rate of evaporation of solutions. S. I. SKLJARENKO and M. K. BARANAEV (J. Phys. Chem. Russ., 1938, **12**, 271—276).—Unimol. layers of cetyl alcohol (I) reduce the rate of evaporation of HCl and of H_2O from 21% and 36% HCl by 60—92%, whilst films of lauric, palmitic, and oleic acid (II) have no effect. If H_2 is passed over the surface of the solution the reduction of evaporation by (I) is even greater. Evaporation of $CHCl_3$ through a thick H_2O layer is reduced by $>90\%$ if the H_2O layer is covered by (I) or (II); this reduction presumably is due to the absence of convection currents in the surface in the presence of monolayers. J. J. B.

Deposition of protein multilayers. R. B. DEAN, O. GATTY, and E. STENHAGEN (Nature, 1939, **143**, 721—722).—Factors which may invalidate the estimation of the thickness of a surface layer of protein at a given pressure from measurements on multilayers are discussed. L. S. T.

Properties of liquid layers containing few molecules. D. RĂDULESCU and F. RĂDULESCU (Kolloid-Z., 1939, **87**, 241—251).—The mol. radius (σ) calc. from the discontinuities in the v.p. of liquids in small capillaries or in their desorption isotherms is $<$ that for the same liquids in bulk (cf. A., 1937, I, 458). Discussion of the packing effect in adsorbed layers or menisci of high curvature leads to the inference that σ for CH_2PhCl should be $<$ for C_6H_6, in agreement with measurements. From desorption measurements with CCl_4 the thickness of the layer within which close packing occurs is calc. to be 10—15σ. The decrease of free energy resulting from close packing is ~12 g.-cal. per mol. for CCl_4. F. L. U.

Parachor, desorption isotherm, and molecular radius. F. RĂDULESCU (Kolloid-Z., 1939, **87**, 280—283).—The simple relation obtained by eliminating γ from the expression for $[P]$ and the formula connecting v.p. with radius of curvature (r) of a liquid surface enables the val. of r and consequently of σ

(mol. radius) to be calc. from desorption isotherms (cf. preceding abstract). For CH_2PhCl and CCl_4 close agreement is found between vals. of σ calc. by using (a) vals. of γ, $d_{liq.}$ and $d_{vap.}$ determined by the author or taken from the literature and (b) theoretical vals. of $[P]$. F. L. U.

Ageing of surfaces of solutions. V. Calculation of velocity of activated concentration of dye in the surface of benzopurpurin 10B solutions. K. S. G. Doss (Kolloid-Z., 1939, **87**, 272—275; cf. A., 1939, I, 195).—The velocity calc. with the help of Wheeler's theory (Trans. Nat. Inst. Sci., India, 1938, **1**, 340) is, for dil. solutions (0·00025m.), of the same order of magnitude as that observed. F. L. U.

Capillary-active properties of aqueous solutions of the sodium salts of higher alkylsulphuric acids. W. KIMURA and H. TANIGUCHI (J. Soc. Chem. Ind. Japan, 1939, **42**, 89—94B).—The surface (γ) and interfacial (σ) tensions towards ceresin of 0·0005—0·5% solutions of Na lauryl- (I), myristyl- (II), cetyl- (III), and stearyl- (IV) -sulphate in H_2O, $2N-H_2SO_4$, $2N-NaOH$, and aq. $CaCl_2$ (100° hardness) have been determined at 40° and 60°. In aq. solutions γ and σ decrease with increasing concn. (c), but pass through a min. at a val. of c which is lowest for (IV) and highest for (I). Addition of H_2SO_4 reduces γ and σ and shifts the min. to lower c. Addition of NaOH reduces γ considerably for (I), (II), and (III), but increases it for (IV). NaOH reduces σ for all the solutions, but the effect is the less the longer is the C chain. Addition of $CaCl_2$ reduces γ and σ for solutions of (I) and (II), but increases them for (III) and (IV). γ and σ for solutions of (I) are increased, but for solutions of (IV) are decreased, by rise of temp. The changes in solubility, γ and σ with increasing length of the C chain are discussed. J. W. S.

Influence of sodium sulphate on the capillary-active properties of aqueous solutions of [sodium salts of] higher alkylsulphuric acids. W. KIMURA and H. TANIGUCHI (J. Soc. Chem. Ind. Japan, 1939, **42**, 95—98B; cf. preceding abstract).—Addition of Na_2SO_4 (0·1—0·5%) lowers the surface tension and interfacial tension towards ceresin of Na lauryl-, myristyl-, cetyl-, and stearyl-sulphate. J. W. S.

Rise of liquids in capillaries. F. J. NELLENSTEYN (Chem. Weekblad, 1939, **36**, 416).—A reply to Loman (A., 1939, I, 368). S. C.

Dielectric potential and surface tension of certain physiologically active compounds. B. ZAPIÓR (Rocz. Chem., 1939, **19**, 323—332).—The dielectric potential–concn. curves for aq. solutions of n-butyl, tert.-amyl, and trichlorobutyl alcohol, paraldehyde, urethane, sulphonal, trional, veronal, luminal, phenacetin, p-aminoacetophenone, and antipyrine are parallel with the corresponding surface tension–concn. curves. R. T.

Influence of electrolytes on emulsion type and stability. A. KING and G. W. WRZESZINSKI (Trans. Faraday Soc., 1939, **35**, 741—743).—50% kerosene–H_2O emulsions stabilised with gum dammar, C black, agar, lecithin, bentonite, egg yolk, saponin, gum

acacia, Daxad, $Zn(OH)_2$, and $Al(OH)_3$ do not undergo phase reversal when treated with NaOH, NH_3, HCl, $Al_2(SO_4)_3$, or $Th(SO_4)_2$, nor is their stability affected except when the emulsifying agent is destroyed by chemical change.   F. L. U.

Colloid-chemical investigations of three liquid components. III. Emulsification of two-liquid systems with equal specific gravities. N. SATA and H. OKUYAMA (Bull. Chem. Soc., Japan, 1939, **14**, 147—152).—Two-liquid systems of equal sp. gr. were prepared by mixing suitable proportions of three liquids of different miscibilities and sp. gr. Emulsification and coagulation phenomena have been investigated under various conditions for the systems: $C_6H_6-H_2O-CCl_4$; $H_2O-CH_2Bu^\beta\cdot OH-CHCl_3$; $H_2O-MeOH-C_6H_6$.   W. R. A.

Mutual interaction energy of two hydrophobic colloidal particles. G. P. DUBE and S. LEVINE (Compt. rend., 1939, **208**, 1812—1814; cf. A., 1939, I, 318).—An expression is derived for the interaction energy (E) of two spherical charged particles in an aq. electrolyte solution. E has a max. val. for small separations, and passes through a min. and tends asymptotically to zero as the separation increases. The max. E val., which decreases with increasing electrolyte concn. or particle diameter, probably determines the rate of coagulation. The min. val. may account for thixotropic phenomena.   A. J. E. W.

Depolarisation of light traversing starch suspensions. N. CALINICENCO (Compt. rend., 1939, **208**, 1807—1809; cf. A., 1939, I, 368).—The depolarisation angle (α) for starch suspensions is $\propto$ the diameter of the particles. α decreases with rising temp., and becomes zero at 66° or 82° (with potato and rice starch, respectively), owing to disintegration of the particles. α is of the same order in H_2O, $COMe_2$, PhMe, petroleum, and xylene, and is thus independent of n. The amylose pptd. from starch paste causes slight depolarisation, the supernatant amylopectin giving none. Depolarisation is due in each case to birefringence of the suspended particles.   A. J. E. W.

Influence of secondary scattering on depolarisation measurements. R. S. KRISHNAN (Proc. Indian Acad. Sci., 1939, **9**, A, 303—308).—Measurements of the depolarisation factors in a dil. milk solution and in a $PhOH-H_2O$ mixture show that in emulsions and protein solutions the secondary scattering has a marked influence on these factors. Secondary scattering can be eliminated by illuminating with a narrow incident beam and then measuring the depolarisation factors by the Cornu method.   W. R. A.

Thickness of the layers of dispersion medium in plastic suspensions of mica. M. P. VOLAROVITSCH and I. S. EROCHIN (J. Phys. Chem. Russ., 1938, **12**, 277—279).—If a cylinder rotates in a mica suspension in mineral oil the viscosity of the latter decreases with time to a const. val. The "yield val." in this steady state rapidly increases with the mica concn. From these concns. the thickness of the oil layers between the mica lamellæ is calc.   J. J. B.

Conditions of formation of hydrosols. II. N. N. ANDREEV (J. Gen. Chem. Russ., 1939, **9**, 228—232).—The stability of hydrosols of hydrocarbons, alcohols, aldehydes, acids, ketones, ethers, and other org. compounds depends on the magnitude of the dipole moment of the dispersed phase. (Cf. A., 1938, I, 310.)   R. T.

Determination of degree of dispersity of leucocompounds by diffusion method. P. S. VASILIEV and N. M. DESCHALIT (J. Phys. Chem. Russ., 1938, **12**, 477—478).—An apparatus for measuring rates of diffusion under anaërobic conditions is described. Measurements with leuco-compounds of indanthrene dyes point to the dispersity being approx. mol.   R. C.

Cupric hydroxide sol. R. N. MITTRA (J. Indian Chem. Soc., 1939, **16**, 175—182).—Data on η, coagulation, and ion adsorption are recorded.   F. L. U.

Formation and properties of silver bromide sol. G. H. JONKER, H. R. KRUYT, and L. S. ORNSTEIN (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 454—460).—The conductivity, extinction cceff., [Br'], and cataphoretic velocity of 10^{-4}—10^{-6}M-AgBr sols (from dil. aq. KBr and $AgNO_3$) have been measured at various periods after prep. and in presence of slight excess of $AgNO_3$ or of KBr. The results indicate that the turbidity which develops in the sol is due to flocculation rather than to recrystallisation. Br' is adsorbed initially on the particles, but after ~20 hr. Ag˙ is adsorbed. All the sols examined, however, turn negative on keeping, owing to the formation of a new double layer of unknown structure. The effects of adding electrolytes are in accord with this view.   J. W. S.

Colloidal impurities in distilled water. S. W. PENNYCUIK and C. E. WOOLCOCK (J. Physical Chem., 1939, **43**, 681—685).—Sometimes "conductivity H_2O" contains traces of impurities which inhibit the formation of fine-grained, stable Au sols by CH_2O reduction and it is shown that some of these impurities are positively charged hydrophobic colloids. Their inhibitory action is diminished by: (a) slow freezing from the outside and subsequent thawing after $\not<24$ hr. in the solid state; (b) keeping for ~2 weeks in Pyrex flasks; (c) redistillation; (d) addition of amounts of $SnCl_4$ as small as 1 part in 10^7 at p_H between 9·7 and 10·3.   W. R. A.

Dialysis in the study of colloids. V. Colloidal gold. VI. Colloidal vanadium pentoxide. B. N. DESAI, P. M. BARVE, and Y. S. PARANJPE (Proc. Roy. Soc. Edin., 1939, **59**, 22—37; cf. A., 1937, I, 131).—With progressive dialysis, cataphoretic speed (v) passes through a max. in the case of V_2O_5 and Au, while the conductivity (κ) decreases continuously. Stability passes through a max. with Au, and decreases continuously with V_2O_5. In both cases v and κ decrease, and stability increases, with dilution, whilst addition of increasing amounts of univalent cations increases, then decreases, v. Bivalent ions produce a decrease in v, followed in the case of V_2O_5 by an increase and then a further decrease. Ageing and exposure to sunlight cause a decrease in v, κ, and stability. The conception of a crit.

potential is not supported. In dialysis of V_2O_5, η is a min. for max. v.　　　　L. J. J.

Action of heat on concentrated solutions of titanium and of zirconium in hydrochloric acid. (MME.) H. EMMANUEL-ZAVIZZIANO (J. Chim. phys., 1939, **36**, 111—116).—Solutions containing 0·6—2·5 g. of TiO_2 per 100 c.c. and 1·6—2N. with respect to HCl are nearly completely hydrolysed after boiling for 2 hr., about 0·03 g. of TiO_2 remaining in solution. Similar solutions of ZrO_2 are not pptd. under these conditions. With solutions containing both oxides pptn. either does not occur or is incomplete; in the latter case the ppt. contains both oxides in approx. the same proportion as the initial solution. This behaviour is explained in terms of the structure of oxide hydrosols proposed by Thomas et al. (cf. A., 1935, 1459).　　　　F. L. U.

Macromolecular chemistry. H. STAUDINGER (Freiburger Wissensch. Ges., 1939, No. 28, 1—32).—A lecture.　　　　F. L. U.

Macromolecular compounds. CCXV. Osmotic pressure of aqueous solutions of multivalent acids and their salts. W. KERN (Z. physikal. Chem., 1939, **184**, 197—210).—Additional osmotic data on solutions of neutral and acid Na salts of a polyacrylic acid are recorded and are discussed theoretically with reference to the buffering action of cations (cf. A., 1938, I, 192).　　　　C. R. H.

Soaps and similar long-chain derivatives as simple half-strong electrolytes in dilute solution. J. W. McBAIN (J. Physical Chem., 1939, **43**, 671—679).—The recently proposed reinterpretation of colloidal electrolytes is incompatible with the thermodynamic data obtained for dil. solutions of soaps (osmotic, f.p., and lowering of v.p. data), the osmotic effects being $\gg$ can be accounted for by colloid and simple ions. Such solutions are very similar to those of $CHCl_2 \cdot CO_2H$ in which simple mols. (or neutral ion-pairs of identical formula) and ions only are present. These precede the formation of ionic micelles. At high concns. the existence of neutral micelles has been established by X-ray examination.　　　　W. R. A.

Degree of aggregation of dyes in dilute solution. I. Conductivity measurements. C. ROBINSON and H. E. GARRETT. **II. Osmotic pressure measurements.** C. ROBINSON and J. W. SELBY (Trans. Faraday Soc., 1939, **35**, 771—780, 780—784).—I. Conductivities of Me-orange (I), Bordeaux extra (II), "meta" benzopurpurin (III), benzo-purpurin 4B (IV), Congo-red (V), and the azo- (VI), disazo- (VII), and trisazo- (VIII) -dyes formed by coupling diazotised metanilic acid with successive mols. of 4-methoxy-m-toluidine, were measured at 25° over the concn. range 8×10^{-3}—6×10^{-6}N. The Λ–$\sqrt{c}$ plots for (I), (II), and (VI) are linear, whilst those for (III), (IV), (V), and (VII) show max. at low concns. Min. and max. aggregation nos. are calc. The mean degree of aggregation increases in the order (II) < (III) < (IV) < (V) < (VII) < (VIII). II. Osmotic pressure data for the same dyes lead to results in qual. agreement with the above.　　　　F. L. U.

Diffusion of glycogen in liquid ammonia. L. SCHMID and A. POLACZEK-WITTER (Monatsh., 1939, **72**, 327—329).—Glycogen dissolved in liquid NH_3 does not diffuse through a cellulose membrane permeable to sucrose.　　　　L. J. J.

Rôle of micellar hydration in the effect of ultra-violet rays on agar solutions. P. PONTHUS (Compt. rend. Soc. Biol., 1939, **130**, 671—672).—Ultra-violet irradiation decreases η when the concn. of alcohol in the dispersing phase is below 50%; above 50% there is no effect.　　　　H. G. R.

Dielectric study of the gelatin–water system : anomalous dispersion in bound (oriented) water. H. FRICKE and L. E. JACOBSON (J. Physical Chem., 1939, **43**, 781—796).—The effects of gelatin concn., p_H, ionic strength, and structural state on the dielectric const. and dielectric absorption of gelatin–H_2O systems have been determined at frequencies between 0·002 and 65·6 megacycles and field intensities between 0·5 and 5 v. per cm. Data indicate that the dielectric properties depend on a polarisation at the interfaces in the same way as for more coarsely dispersed systems. The hypothesis that the polarisation arises in the interfacial layer of oriented H_2O mols. is advanced and is discussed with reference to the dielectric behaviour of hygroscopic insulators, soil, cell membranes, and metal electrodes.　　　　W. R. A.

Dynamic birefringence (Maxwell effect) of glycerinated protein solutions. C. SADRON, A. BONOT, and H. MOSIMANN (J. Chim. phys., 1939, **36**, 78—83; cf. A., 1938, I, 617).—The relations existing between the birefringence (δ) of solutions and the properties of their constituents make it possible to determine from measurements of δ the coeffs. of diffusion and principal polarisabilities of the particles. Preliminary experiments with solutions of serum albumin and serum globulin (I) in 50 vol.-% aq. glycerol gave results in accord with previously established data. Total (I) in aq. glycerol behaves as a mixture of constituents having δ of opposite signs, but in H_2O as a single substance, owing to the presence of a lipin–globulin complex stable in H_2O but dissociated in aq. glycerol. Extraction of lipins from (I) causes it to behave as a single substance in aq. glycerol.　　　　F. L. U.

Behaviour of inorganic ions during ultrafiltration of protein solutions containing sodium chloride. E. J. BIGWOOD and M. ERRERA (Bull. Soc. Chim. biol., 1939, **21**, 737—744).—When the p_H of protein solutions containing NaCl is near that of the isoelectric point of the protein the [Na·] and [Cl′] in the colloidal solution and its ultrafiltrate are the same. At any other p_H the distribution of the ions is in accordance with the Donnan theory (cf. Ambard and Devillers, A., 1935, 1012).　　　　A. L.

Periodic precipitation in absence of foreign gel. II. Ferric hydroxide sol [prepared] by different methods. R. N. MITTRA (J. Indian Chem. Soc., 1939, **16**, 165—174).—Further work on the formation of rings from $Fe(OH)_3$ sols during coagulation (cf. A., 1937, I, 410) shows that the effect depends on speed of coagulation and vol. of the coagulum as well

as on adsorption of the sol by the coagulum. Sols prepared by hydrolysing $FeCl_3$ show the greatest adsorption but give no rings.　　　F. L. U.

Coacervation. II. Osmotic pressure. (MME.) A. DOBRY (J. Chim. phys., 1939, **36**, 102—110; cf. A., 1939, I, 198).—Equality of the osmotic pressures (Π) of coacervates and the solutions in equilibrium with them has been proved experimentally for the ternary system cellulose acetate (I)–$CHCl_3$–EtOH. For 2·4% of (I) the lowest vals. of Π occur in the range of [EtOH] corresponding with coacervation, which is therefore considered to represent the limit of dissolution. The relation between $\Pi/[(1)]$ and $[(1)]$ is linear, the limiting val. of $\Pi/[(I)]$ for $[(I)] = 0$ being the same for all compositions of the solvent, whilst for compositions giving coacervation the real and apparent mol. wts. are the same over a wide range of $[(I)]$. Van der Waals' formula is not applicable to coacervated systems, which bear only a limited analogy to liquid–vapour systems. Coacervation has been observed in a binary system of $CHCl_3$ and cellulose acetate (OAc 55·9%).
　　　F. L. U.

Cataphoresis in insulating media. A. GEMANT (J. Physical Chem., 1939, **43**, 743—748).—The validity of the Helmholtz equation for insulating media is theoretically discussed, and the various factors (field strength, dielectric const., η, boundary potential) in insulating liquids which affect the cataphoretic velocity are considered. The cataphoresis of suitable suspensions of polystyrene in *m*-xylene–mineral oil mixtures has been investigated: (i) by obtaining visible deposits of the resin on metallic electrodes, and (ii) by a quant. microscopic examination of the motion. The data indicate an anodic motion, with the boundary potential ~30 mv. Addition of acids stabilises the suspensions, but alkali hastens coagulation by reversing the negative charge of the particles.
　　　W. R. A.

Electrophoretic properties of thymonucleic acid. E. STENHAGEN and T. TEORELL (Trans. Faraday Soc., 1939, **35**, 743—750; cf. A., 1938, I, 249).—The p_H-mobility (*v*) curve for thymonucleic acid (I), measured over the range p_H 3—10, is similar to the base-binding curve in the same range, indicating that all ionisable groups are electrophoretically active. *v* is independent of concn. between 0·05 and 0·25% in spite of a large increase in η of the solution, an observation which suggests the need for caution in applying corrections based on the apparent η to experimental *v* data. *v* increases linearly with potential gradient between 1 and 12 v. per cm.: this effect cannot be entirely accounted for by local heating, and may be due to increased orientation of rod-shaped particles in the direction of migration. The *v* of mixtures of (I) with seralbumin provide evidence of interaction on the alkaline side of the isoelectric point.　　　F. L. U.

The ζ-potential at the boundary surface between solid and water in relation to the internal micellar and crystalline structure of the former. I. Variation of ζ-potential of cellulose hydrate during its direct conversion into ordinary cellulose. K. KANAMARU and T. TAKADA (Z. physikal. Chem., 1939, **184**, 179—196).—The treatment of cellulose hydrate (commercial viscose silk)

with $(CH_2 \cdot OH)_2$ at 250°, as a result of which it is converted into ordinary cellulose, is accompanied by an increase in the equilibrium val. of the ζ-potential, ζ_∞, at the solid–H_2O interface. ζ_∞ is more rapidly attained with the untreated than with the treated product. In both cases ζ_∞ is more rapidly attained with slowly spun silks, although the differences for different rates of spinning are less noticeable with the treated product. The treatment also reduces hygroscopicity. The data are explained on the basis of Kanamaru's theory (cf. A., 1937, I, 80, 305, and subsequently).　　　C. R. H.

Electrokinetics. XXI. Electrokinetic theory. Streaming potential and the electro-osmotic counter-effect. M. A. LAUFFER and R. A. GORTNER (J. Physical Chem., 1939, **43**, 721—732; cf. A., 1938, I, 397).—The application of the Helmholtz theory to studies of the streaming potential (H) involving org. liquids is justified because H of such systems is $\propto$ the pressure of streaming. Further, the electro-osmotic counter-pressure theory has been confirmed for the systems X–cellulose (X = MeOAc, EtOAc, Pr^aOAc, Bu^aOAc, *n*-$C_5H_{11} \cdot OAc$, HCO_2Et, $EtCO_2Et$, and Pr^aCO_2Et). The effective mean pore size of a cellulose diaphragm containing EtOAc, calc. on the basis of the back pressure theory, is 0·27 μ.
　　　W. R. A.

Effect of addition of non-electrolytes and of temperature on times of setting of transparent inorganic gels. M. PRASAD and D. M. DESAI (J. Indian Chem. Soc., 1939, **16**, 117—126).—For the transparent gels (arsenates of Th, Sn····, Mn, Zn; phosphates of Th, Sn····, Ce; and Th molybdate) (A., 1939, I, 259), the time of setting, *t*, is increased, except with Mn arsenate, by addition of non-electrolytes (MeOH, EtOH, PrOH, glycerol, and C_5H_5N). For all, except Th arsenate, *t* is decreased as temp. is increased, due to an increase in agglomeration tendency and a decrease in hydration tendency. Heats of activation have been deduced from curves of log *t* against $1/T$. The anomalous behaviour of Th arsenate with change of temp. and of Mn arsenate on addition of electrolytes is discussed.　　　W. R. A.

Deformation and fine structure of hydrocellulose. VIII. Relation between anisotropy of swelling and mechanism of deformation in hydrocellulose gels. P. H. HERMANS and P. PLATZEK (Kolloid-Z., 1939, **87**, 296—308).—Data recorded in Parts II and III are corr. (A., 1938, I, 79, 139). Strict comparison between experimental and calc. vals. of the anisotropy of swelling (Q) is possible only when this quantity and the extension (*v*) are referred to material in the unswollen state. When Q and *v* are thus expressed the Q–*v* curves are in close agreement with X-ray results for stretched dry fibres, and are compatible only with a micro-heterogeneous fine structure.　　　F. L. U.

X-Ray diffraction study of the swelling action of several quaternary ammonium hydroxides on cellulose fibres. W. A. SISSON and W. R. SANER (J. Physical Chem., 1939, **43**, 687—699).—On treatment with quaternary NH_4 hydroxides both native and mercerised cellulose fibres (*a*) increase in diameter due to the swelling of inter-cryst. material, and (*b*)

yield a new X-ray diagram attributed to the formation of a swelling compound between the reagent and the cryst. cellulose. This new diagram appears only above a sp. concn. of the hydroxide employed and is unaltered by increase in the amount of hydroxide added. Data for various hydroxides are given and discussed. The effect of heat on the X-ray patterns depends on the nature of the hydroxide. On washing with dil. acid and H_2O the complex reverts to hydrated cellulose.   W. R. A.

Swelling and dissolution of casein and starch in formamide. H. ERBRING (Kolloid-Z., 1939, **87**, 308—311).—Rennet-casein dissolves completely in aq. $HCO \cdot NH_2$ (I) containing $\not< 50\%$ of (I), and swells in more dil. mixtures. Substitution of EtOH for H_2O results in diminished swelling and prevents dissolution. Acid-casein does not dissolve in pure or aq. (I), but swells to an extent increasing with concn. of (I), the initial rate of swelling being greatest for $\sim 50\%$ of (I). Starch forms clear viscous solutions in (I), whilst in aq. (I) the transparency to light decreases regularly with decreasing concn. of (I).   F. L. U.

Viscosity of aqueous solutions of strong electrolytes. IV. Viscosimetric detection of higher-order molecules in aqueous solutions. H. TOLLERT (Z. physikal. Chem., 1939, **184**, 150—158).—η data for aq. solutions of pairs of salts indicate the existence in solution of $MgCl_2,KCl$ and $(NH_4)_2SO_4,2ZnSO_4$. No evidence of complex formation in NaCl–KCl solutions has been obtained. The conclusions support those of Spacu and Popper based on η data (A., 1934, 723).   C. R. H.

First dissociation of carbonic acid. Y. KAUKO and H. ELO (Z. physikal. Chem., 1939, **184**, 211—230).—Vals. for the first dissociation const. of H_2CO_3 and the respective methods of determination are critically examined.   C. R. H.

Hydrolysis of a salt derived from a weak acid and a weak base. S. J. O'BRIEN and C. L. KENNY (J. Chem. Educ., 1939, **16**, 140—142).—Except for very low salt concns., the degree of hydrolysis need not be determined separately for each ion. Data in the literature for the hydrolysis of these salts at room temp. are tabulated.   L. S. T.

Specific thermodynamic properties of dilute ionic solutions. J. KIELLAND (J. Physical Chem., 1939, **43**, 797—803).—Simple equations of the Debye–Hückel–Brönsted–Guggenheim type and parameters with numerical tables are given for ~ 100 electrolytes at 0° and 25°. By means of these, osmotic and activity coeffs. may be computed for solutions of one or more electrolytes. The accuracy diminishes with solutions for which the ionic strength exceeds 0.1M.   W. R. A.

Activity coefficients and transport numbers of zinc bromide at 25° from e.m.f. measurements. H. N. PARTON and J. W. MITCHELL (Trans. Faraday Soc., 1939, **35**, 758—765).—From the e.m.f. of cells both with and without liquid junction, activity coeffs. of $ZnBr_2$ at 25° from 0·02 to 16M. have been calc. The standard potential of the Zn electrode is calc. to be 0.7628 v. Transport nos. of aq. $ZnBr_2$ are calc. and discussed.   F. L. U.

Vapour pressure of solutions saturated with potassium thiocyanate and with potassium chloride, bromide, or iodide. P. DINGEMANS (Rec. trav. chim., 1939, **58**, 574—581).—The v.p. of solutions saturated with KCNS, KCNS and KCl, KCNS and KBr, and KCNS and KI have been determined between 10° and the m.p. or eutectic temp.   F. J. G.

Sucrose and liquid ammonia. I. Vapour pressure of liquid ammonia solutions of sucrose. M. AMAGASA, K. ITÔ, and K. NISHIZAWA (J. Soc. Chem. Ind. Japan, 1939, **42**, 65—69B).—The v.p. temp. and v.p.–concn. relations for 40—72·5% solutions of sucrose (I) in liquid NH_3 are given between $-4.95°$ and $13.79°$. The differential heats of vaporisation of the solutions, the mol. depression of v.p. (assuming Raoult's law), and the mol. association of (I) are calc. At low temp. in conc. solution (I) is apparently dissociated, probably on account of the association of NH_3 and the ammoniation of (I). A preliminary estimation of the v.p. of the saturated solution is given.   W. A. R.

Solubility in water of cadmium perchlorate and its hydrates. H. HERING and A. LERAY (Bull. Soc. chim., 1939, [v], **6**, 1034—1041).—The system $Cd(ClO_4)_2$–H_2O has been studied between the eutectic temp. ($-66.5°$) and 247°. The only solid phases which occur are $Cd(ClO_4)_2$, $Cd(ClO_4)_2,6H_2O$ (m.p. 129·4°), and the *dihydrate*, which exists in two forms, the β-form having congruent m.p. 157·9° and passing into the α-form at $<66°$. No evidence was found for the existence of $Cd(ClO_4)_2,4H_2O$ (cf. Salvadori, A., 1912, ii, 649).   J. W. S.

Two-component systems with germanium. I. Germanium–aluminium, germanium–tin, and germanium–silicon. H. STÖHR and W. KLEMM (Z. anorg. Chem., 1939, **241**, 305—323).—The systems have been investigated by means of cooling curves and X-rays. Ge and Al form a eutectic at 424°, with 29·5 at.-% Ge (cf. B., 1927, 488). The solubility of Ge in Al rises from 0·2 at.-% at 177° to ~ 2.0 at.-% at 395°. That of Al in Ge at 395° is $\not> 3$—4 at.-%. Ge and Sn form a eutectic at 232°, with almost 100% Sn. At 195° the solubility of Ge in Sn is <0.6 at.-%, and that of Sn in Ge <1.0 at.-%. Ge and Si form a complete series of mixed crystals in which the lattice consts. are approx. additive. The types of systems formed by pairs of elements in general are discussed in the light of at. radii and position in the periodic table.   F. J. G.

Melting lines of potassium thiocyanate with potassium chloride, bromide, and iodide. P. DINGEMANS (Rec. trav. chim., 1939, **58**, 559—573).—The m.p. of KCNS is 176·6°. The systems KCNS–KCl, KCNS–KBr, and KCNS–KI are of the simple eutectic type, the respective eutectic temp. being 172·5°, 170·2°, and 168·0°, and the compositions 2·45% KCl, 5·90% KBr, and 10·7% KI. The curves from the m.p. of KCNS to the eutectics are straight lines, from which the heat of fusion of KCNS is calc. to be 3130, 3185, and 3035 kg.-cal. per g.-mol.   F. J. G.

Binary system phenylhydrazine–*p*-chlorophenol. N. A. PUSHIN and G. M. DIMITRIJEVIĆ

(Z. physikal. Chem., 1939, **184**, 231—237).—From cryoscopic data for mixtures of $NHPh\cdot NH_2$ (A) and p-$C_6H_4Cl\cdot OH$ (B), the existence of $2A,B$, A,B, and $A,3B$ has been demonstrated. A fourth complex of uncertain composition is also indicated. B exists in two modifications. If liquid B is supercooled to $<34°$ β-B crystallises. It is metastable at room temp. and atm. pressure and gradually changes to α-B.

C. R. H.

Nickel sulphate and cobalt sulphate. R. ROHMER (Ann. Chim., 1939, [xi], **11**, 611—721).—A detailed account of work already noted (A., 1934, 255, 1187; 1935, 1461; 1938, I, 412) is given, and equilibrium data are recorded for the system $NiSO_4$-$CoSO_4$-H_2O between $0°$ and $61°$. The solid phases are always mixed crystals, of which there are in all four series, viz., monoclinic and orthorhombic heptahydrated, monoclinic and quadratic hexahydrated. F. J. G.

Reversible pairs of salts.—See B., 1939, 716.

Physico-chemical analysis by determination of eutexy lines. E. CORNEC and M. LEHNÉ (Compt. rend., 1939, **208**, 1816—1818).—The method consists in determining the temp. (θ_s) at which a solution of two salts commences to deposit solid salt in addition to ice. θ_s (determined experimentally with rising temp.) depends only on the relative proportions of the salts present. A plot of θ_s against the composition of the salt mixture shows a ternary eutexy point with K_2SO_4, KNO_3, and ice; $NiSO_4,7H_2O$-$ZnSO_4,7H_2O$ and KCl-KBr give continuous series of mixed crystals, the curve for the latter containing a min. $MgSO_4$ and $(NH_4)_2SO_4$ give congruent $(NH_4)_2SO_4,MgSO_4,6H_2O$; the corresponding K salt is incongruent at the eutexy temp. $MgSO_4$ hydrates with 11, 9, and $7H_2O$ give different eutectic temp. $(-3\cdot9°, -4\cdot9°, -5\cdot2°)$ with ice. A. J. E. W.

Systems alkali oxide–CaO–Al_2O_3–SiO_2–CO_2. VIII. Reaction pressures of quartz and disilicate with alkali double carbonates. C. KRÖGER and K. W. ILLNER (Z. anorg. Chem., 1939, **241**, 338—348; cf. A., 1935, 935, 1323).—When $KNaCO_3$ (I) is heated with SiO_2 the pressures for 25—55% reaction correspond with those obtained for K_2CO_3 or Na_2CO_3, but higher pressures are obtained for $<25\%$ reaction. These correspond with the formation of an alkali oxide–SiO_2 solid solution as a result of greater mobility in the lattice, corresponding with the lower m.p. of the double carbonate. With $2(I) + Na_2Si_2O_5$ the pressures obtained correspond with those obtained for the corresponding equilibrium in the system Na_2O-SiO_2-CO_2, so that Na_2SiO_3 and K_2CO_3 are the products. With $Na_2Si_2O_5$ in excess the pressures are in the same range, the products being $K_2Si_2O_5$ and Na_2SiO_3. With $LiNaCO_3$ and SiO_2 analogous results are obtained. In neither case does the use of the double carbonate cause an appreciable acceleration of the reaction. F. J. G.

International temperature scale and some related physical constants. H. T. WENSEL (J. Res. Nat. Bur. Stand., 1939, **22**, 375—395).—With a view of defining a temp. scale above $1063°$ in as close correspondence as possible with the thermodynamic scale, the vals. of c_2 in Planck's radiation formula, and of a no. of related consts., are reviewed. F. J. G.

Heat and free energy of formation of water and of carbon monoxide. F. D. ROSSINI (J. Res. Nat. Bur. Stand., 1939, **22**, 407—414).—Calorimetric and thermodynamic data are combined to give vals. for the heat and free energy of formation of H_2O and CO, and for the water-gas and producer-gas reactions, each substance being in the thermodynamic standard state. F. J. G.

Effective molecular heats and their use in calculation of combustion temperatures. G. RIBAUD (Arch. Wärmewirts., 1939, **20**, 72—74).—The effective mol. heats of CO_2 in $CO_2 + nN_2$, $CO_2 + 0\cdot2O_2 + nN_2$, and $CO_2 + 0\cdot4O_2 + nN_2$, of H_2O in $H_2O + nN_2$ ($n = 2, 4, 8, 12$, and 16) over the range 1300—2700°, and the heats of combustion of CO and CH_4 in air, are tabulated. The application of the data to the determination of the combustion temp. of various mixtures is illustrated by examples. R. B. C.

New method of calculating combustion temperatures and its application to mixtures of alcohol vapour, water vapour, and oxygen. Calculation of enthalpy, entropy, heat capacity, and reduced thermodynamic potential of ethyl alcohol vapour. H. ZEISE (Z. Elektrochem., 1939, **45**, 456—463, cf. B., 1938, 1005).—Thermodynamic consts. of steam and EtOH vapour and vals. of the equilibrium const. for the reaction $EtOH + H_2O = 2CO + 4H_2$ from $400°$ to $1400°$ have been calc. theoretically from thermochemical and spectroscopic data. J. A. K.

Heats of combustion of tetramethylmethane and β-methylbutane. J. W. KNOWLTON and F. D. ROSSINI (J. Res. Nat. Bur. Stand., 1939, **22**, 415—424).—The heats of combustion in O_2 at $25°$ and 1 atm. of gaseous CMe_4 and $CHMe_2Et$ to gaseous CO_2 and liquid H_2O are $840\cdot61\pm0\cdot23$ and $843\cdot36\pm0\cdot15$ kg.-cal. per g.-mol., respectively. F. J. G.

Thermochemistry of paraffins and aliphatic alcohols. H. C. BLANCK (Z. physikal. Chem., 1939, **43**, B, 153—172).—Theoretical. Considerations based on variations in the heat of combustion caused by introducing substituents into paraffins and aliphatic alcohols enable a quant. definition of valency energy to be made. Intramol. reciprocal effects are discussed and semi-empirical calculations of their vals. have been made. C. R. H.

Formation and decomposition of ozonides considered from the point of view of energy. E. BRINER (Helv. Chim. Acta, 1939, **22**, 591—600).—The heats of ozonisation of various org. compounds indicate that the decomp. of ozonides, either into two residues or with complete disruption of the mol., is strongly exothermic. The two modes of decomp. therefore always occur simultaneously, the relative yields of each process being determined by the nature of the ozonide and its solvent and temp. J. W. S.

Free energy and heat of formation of cuprous sulphide from electromotive force measurements. A. F. KAPUSTINSKI and I. A. MAKOLKIN (J. Phys. Chem. Russ., 1938, **12**, 361—370).—From measurements with the cell $Pt|H_2$ (P atm.)$|HCl$ (X_M.)$||HCl$ (X_M.)$|H_2S$ (P atm.)$|Cu_2S$ (α) at 15—35° the free energy of formation of Cu_2S, $\Delta G'_{293}$, has been

found to be −19,220 and the heat of formation, $\Delta H_{298}^{\bullet}$, to be −18,500 g.-cal.   R. C.

Electrochemical determination of free energies and heats of formation of lead and stannous sulphides. A. F. KAPUSTINSKI and I. A. MAKOLKIN (J. Phys. Chem. Russ., 1938, **12**, 371—379).—From e.m.f. measurements with the cells Pt|H₂ (*P* atm.)| HCl (*X*M.)||HCl (*X*M.)|H₂S (*P* atm.)|PbS or SnS at 15—35°, the vals. of $\Delta G_{298}^{\bullet}$ and $\Delta H_{298}^{\bullet}$ for the reaction Pb + S (rhombic) = PbS have been found to be −20,993 and −22,490 g.-cal., respectively, the corresponding vals. for the reaction Sn + S (rhombic) = SnS being −19,680 and −18,180 g.-cal., respectively. The solubility product of SnS is 1×10^{-27}.   R. C.

Progressive breakdown in a conducting liquid. L. B. SNODDY and J. W. BEAMS (Physical Rev., 1939, [ii], **55**, 879).—In an investigation of a comparatively slow type of liquid breakdown, observations on a discharge (∼10 kv. per cm. max.) between Cu electrodes under the surface of a CuSO₄ solution in a special cell are reported. Photographs show a marked resemblance to electrical figures observed under insulating liquids.   N. M. B.

Conductometric study of solutions containing citrate and ferric ions, in presence and absence of hydrogen peroxide. M. M. BOBTELSKY and A. E. SIMCHEN (Compt. rend., 1939, **208**, 1646—1647).—The conductivity (κ) data indicate the occurrence of the following equilibria ($X = C_6H_5O_7'''$) : $2[Fe_3X_2]^{\bullet\bullet\bullet} + 5X \rightleftharpoons 3[Fe_2X_3]'''$; $2[Fe_2X_3]''' + 5Fe^{\bullet\bullet\bullet} \rightleftharpoons 3[Fe_3X_2]^{\bullet\bullet\bullet}$. Formation of $[Fe_3X_2]^{\bullet\bullet\bullet}$ by the second reaction is facilitated in presence of H₂O₂, with which it forms an unstable intermediate product giving rise to the decomp. reaction (cf. A., 1939, I, 423). κ is const. during the induction period, but rises rapidly during decomp.; the difference between the initial and final κ vals. is max. and zero with $Fe^{\bullet\bullet\bullet}/X = 3/2$ and 2/3, respectively, the $[Fe_3X_2]^{\bullet\bullet\bullet}$ ion undergoing some change during the reaction. Further quantities of H₂O₂ are decomposed immediately on addition, the initial and final κ vals. being identical.   A. J. E. W.

Electrolytic migration of gold in solid lead–gold alloys. K. E. SCHWARZ and R. STOCKERT (Z. Elektrochem., 1939, **45**, 464—466).—Pb wires containing 0·04% Au were subjected to a current of about 2000 amp. per sq. cm. at a field strength of 0·1 v. per cm. and afterwards cut into sections and the Au content determined. The results showed migration of Au to the anode and determinations of the transport no. at three temp. were in agreement with vals. calc. from the diffusion const. of Au in Pb if the valency was taken as zero.   J. A. K.

Transport of water to anode or cathode through non-aqueous liquids. C. C. RAINEY (Science, 1939, **89**, 435—436).—When equal portions of an aq. salt solution are separated in a U-tube by a non-aq. liquid, and Pt electrodes dipping into the aq. solutions are connected to a supply of d.c., H₂O is transported to the anolyte or catholyte. With (NH₄)₂C₂O₄ or Na₂C₂O₄ as electrolyte and PhCHO or CCl₄ as membrane, H₂O is transported to the cathode; with Cu(NO₃)₂, it goes to the anode. At 110 v.

transport is very slow, but at 450—500 v. a difference in vol. of the anolyte or catholyte is noticeable in 2 days. These effects appear to be due not simply to electroendosmosis, but to movement of hydrated ions. NH_4^+ appears to have a high degree of hydration.   L. S. T.

Potential of lead–cadmium alloys. B. G. PETRENKO, E. E. TSCHERKASCHIN, and E. V. ERMOLAEVA (Trans. Inst. Chem. Charkov Univ., 1938, **4**, No. 13, 57—63).—The solid solubility of Cd in Pb is 5%, as determined from the p.d. between Cd–Pb anodes and a Cd cathode in N-CdSO₄. Anomalous behaviour of alloys containing 8—15% Cd is ascribed to formation of a protective film of PbSO₄ on the Cd crystals, as a result of which the anode behaves as a homogeneous alloy; this effect is nearly absent in alloys subjected to prolonged heating at 200°, and containing large Cd crystals.   R. T.

So-called " oil potentials." G. C. H. EHRENSVÄRD and L. G. SILLÉN (Z. Elektrochem., 1939, **45**, 440—456).—The origin of potentials set up at the interface between an oil and an aq. electrolyte is discussed from the points of view of the partition and the adsorption theories. Apparatus for measuring the e.m.f. of cells of the type electrolyte (concn. 1)| oil|electrolyte (concn. 2) is described, and results are recorded for aq. KCl with PhNO₂, PhCl, COPhMe, and for various mixtures. Similar measurements with aq. methylene-blue gave results in agreement with those calc. from adsorption data by use of activities derived from f.p. depressions. Freshly distilled " oils " showed an ageing effect during the measurements.   J. A. K.

Overvoltage of silver. A. T. VAHRAMIAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 238—241).—Discrepancies in the recorded data for the overvoltage of Ag are discussed in terms of the changes that occur in the active cathode surface and c.d. during electrolysis. There is no direct relationship between the val. of the polarisation and the apparent c.d., and the relationship cannot be established unless c.d. is referred to the active surface of the growing crystal and not to the total cathode surface.   L. S. T.

Influence of surface-active substances and colloids on the overpotential of cadmium and lead. S. F. BILETZKI, E. K. OVETSCHKIN, and I. M. FRANZEVITSCH (Trans. Inst. Chem. Charkov Univ., 1938, **4**, No. 13, 23—48).—Changes in cathode overpotential during electrolysis of 0·5N-CdSO₄ in 0·1N-H₂SO₄ at 0—55° (c.d. 0·0015—8 ma. per sq. cm.), in presence of 0—1% of gelatin, 0·001—0·07M-*o*-cresol, or 0·001—0·05M-*p*-toluidine are recorded. Similar data are given for electrolysis of N-Pb(OAc)₂ in N-AcOH, at 25° (c.d. 0·00055—3 ma.), in presence of 0·001—0·25% of gelatin. The most adherent deposits of Cd are obtained in presence of ≯0·01% of gelatin, at 35°. Dense, finely cryst. deposits are obtained in presence of 0·001M-*o*-cresol or *p*-toluidine.   R. T.

Determination of small concentrations of electrolytes by measurement of the strength of the current in closed circuits. I, II. B. A. RASCHKOVAN (J. Gen. Chem. Russ., 1939, **9**, 203—212,

213—220).—I. The deflexion y of a galvanometer needle in circuit with Hg and Hg–Cu electrodes n cm. apart in aq. solutions of concn. x, at 30°, is expressed by the empirical equation log $y(b + n) = a$ log $x + C$, where a, b, and C are consts. The concn. of 0·0001—0·0005N-$AgNO_3$ is thus determined, with an error $\not>$ +5%.

II. The current developed in the above conditions in solutions containing $AgNO_3$ and an equiv. concn. of K, Na, NH_4, Ca, Sr, Ba, Zn, Co, Ni, or Al nitrates is equal to that which would have been found were the NO_3' combined with Ag alone. The concn. of the enumerated nitrates may be determined from the difference between the val. of y for the $AgNO_3$ alone and together with other nitrates. The method is not applicable to Fe and Cu nitrates.   R. T.

Theory of many-electrode electrochemical systems and its application to corrosion problems. III. Many-electrode galvanic systems. N. D. TOMASCHOV (J. Phys. Chem. Russ., 1938, 12, 414—426).—The investigation previously described (A., 1938, I, 34) has been extended to include systems of 4 and 5 electrodes. In many-electrode systems inclusion of a new electrode as cathode increases the activity of all the anodes and diminishes that of the cathodes, whilst inclusion of a new anode increases the activity of the cathodes and diminishes that of the anodes. The difference effect (cf. A., 1936, 1474) and the action of protectors both seem to depend on diminution in the activity of local elements on the surface of the metal, as a result of diminished activity of the local cathodes in the first case, and lessened activity of the local anodes in the second.   R. C.

Pyrolysis of disilane and trisilane. H. J. EMELÉUS and C. REID (J.C.S., 1939, 1021—1030).— The kinetics of the decomp. of Si_2H_6 and Si_3H_8 have been studied in Si-coated glass bulbs at 314— 360° and 303—350°, respectively. The products are SiH_4, H_2, Si, and small amounts of a solid hydride, probably $(SiH_2)_x$. The increase of pressure is closely parallel to the % decomp. and may be used to follow the reaction. After a short induction period the reactions are approx. unimol., and obey the Arrhenius equation with $E = 51{,}300$ and $43{,}000$ g.-cal. respectively. Addition of H_2 eliminates the induction period, slightly retards the later stages of the reaction, and increases the yield of SiH_4. Packing the tube causes a slight retardation. When the reactions are carried out in presence of C_2H_4, this is polymerised, and some C_2H_6 is produced. The decomp. of one mol. of Si_2H_6 or Si_3H_8 produces polymerisation of approx. 1·0 or 1·3 mols. of C_2H_4, respectively. These results indicate that the reactions are chain reactions involving SiH_3 radicals.   F. J. G.

Kinetics of oxidation of methane. II. Terminal products. W. STARONKA and L. CZERSKI (Rocz. Chem., 1939, 19, 333—346; cf. A., 1939, I, 326).— Oxidation of CH_4 involves the reactions $CH_4 \rightarrow CH_2O \rightarrow CO \rightarrow CO_2$; MeOH is formed in small amounts, probably from CO or CH_2O.   R. T.

Reactivity of lower hydrocarbons. X, XI. Reactions between atomic deuterium and saturated aliphatic hydrocarbons. K. MORIKAWA (J. Soc. Chem. Ind. Japan, 1939, 42, 139—142B, 142—145B; cf. A., 1939, I, 425).—X. No exchange occurs between 25° and 208° between CH_4 and D_2 but at 310° 10% exchange is found. C_2H_6 is decomposed by D_2 above 27°, but exchange occurs only above 100°. The most important fact about reactions between C_3H_8 or C_4H_{10} and D_2 is that comparatively little CH_4 is formed but that this small amount is highly substituted by D.

XI. Reaction mechanisms and bond energies are discussed, and the catalytic reactions are compared with the homogeneous reactions involving free radicals.   T. H. G.

Kinetics of decomposition reactions of the lower paraffins. IV. Rôle of free radicals in decomposition of n-butane. E. W. R. STEACIE and H. O. FOLKINS (Canad. J. Res., 1939, 17, B, 105— 120).—The efficiency of NO in suppressing chains initiated in n-C_4H_{10} at low temp. by means of $(CH_2)_2O$ has been investigated. NO is not completely efficient since sensitisation by $(CH_2)_2O$ persists in presence of large amounts of NO. It is concluded that max. inhibition of org. decomp. reactions by NO does not in all cases correspond with complete suppression of chains, and hence the real chain length may be $>$ that inferred from the results of the NO inhibition method.   D. F. R.

Excitation of chain polymerisation by free radicals. G. V. SCHULZ and G. WITTIG (Naturwiss., 1939, 27, 387—388).—Free radicals produced by thermal decomp. of metal alkyls can induce polymerisation of unsaturated compounds. The effect of free radicals existing in equilibrium in solution on polymerisation has now been investigated. The effect of the addition of tetraphenylsuccinodinitrile (I), which decomposes reversibly into two radicals $CPh_2(CN)$, to styrene at 100° has been examined. The polymerisation is accelerated. The mol. wt. of the product after being kept for 2 hr. with various concns. of (I) was determined. The no. of additional mols. of the polymerides produced increased $\propto \sqrt{[\text{concn. of (I)}]}$, so that the velocity of the primary effect by which the reaction chain is set in progress is $\propto$ concn. of free radical. Control experiments indicate that the nitrile itself is ineffective. The acceleration ceases after about 1 hr. but (I) continues to be used up in an addition reaction.   A. J. M.

Explosibility of gases produced by [coal-] mine fires.—See B., 1939, 681.

Modified form of "life period" method applied to reaction of sodium vapour with bromobenzene. E. WARHURST (Trans. Faraday Soc., 1939, 35, 674—680).—Using the modified method described by Fairbrother and Tuck (A., 1936, 537), the experimental conditions for obtaining trustworthy vals. of the velocity coeff. k for the reaction Na + PhBr = Ph + NaBr have been established. The mean val. of k is $2{\cdot}0 \times 10^{12}$ at 255° and $3{\cdot}1 \times 10^{12}$ at 330°. The activation energy is $3{\cdot}8k$ g.-cal. per mol., and the collision cross-section $5{\cdot}1 \times 10^{-16}$ sq. cm. Saturation of the carrier gas with Na vapour was proved experimentally.   F. L. U.

Kinetics of the decomposition of acetaldehyde-ammonia in aqueous acid solution, and some notes on the aldines. D. T. LEWIS (J.C.S., 1939, 968—972).—When acetaldehyde-ammonia (I) reacts with aq. HCl some of the HCl is neutralised instantly, the rest by a slow reaction which follows the unimol. law. If (I) is kept in aq. solution for a time before treatment with HCl the amount instantly neutralised increases. It is concluded that (I) exists in two forms in solution, an unstable form which reacts instantly with HCl, and a stable form, the transformation of which into the unstable form is the measured reaction. The *compounds* $(CHMe:NH)_n$, m.p. 85°, and $MeCHO,NH_4Cl$ are described. F. J. G.

Velocity of formation of oximes in presence of buffers. P. ANZIANI (Bull. Soc. chim., 1939, [v], 6, 949—954; cf. A., 1938, II, 101).—The velocity (v) of formation of oximes from $COPhMe$, $COPhPr^a$, and $COPhPr^\beta$ has been studied in buffer solutions of p_H 2—10·7. Min. v is observed at p_H 8·7—9·7, but the nature of the buffer solution affects the velocity, especially at p_H 5·2—5·3. At each p_H the vals. of v for the three ketones are in approx. const. ratio, the steric effect of Pr^β being always > that of Pr^a. J. W. S.

Velocity of formation of semicarbazones and of phenylhydrazones. P. ANZIANI (Bull. Soc. chim., 1939, [v], 6, 954—957).—The velocities of reaction of $NH_2 \cdot CO \cdot NH \cdot NH_2,HCl$ (I) and $NHPh \cdot NH_2,HCl$ (2 mols.) with $C_6H_{13} \cdot CHO$, *cyclo*hexanone, and $COPhMe$ (1 mol.) and of (I) with piperonal and $COPhPr^a$ have been studied at 0° in 50% aq. EtOH in presence of various concns. of NaOH. The results indicate that, like oximes (cf. preceding abstract), semicarbazones and phenylhydrazones are more easily produced with the hydrochlorides than with the free bases. In each case optimum conditions for reaction occur in presence of 2 mols. of the hydrochloride, 1·2 mols. of NaOH, and 1 mol. of the aldehyde or ketone. J. W. S.

Kinetics of reactions in which solids participate. II, III. Kinetics of the reduction of iron nitrides by hydrogen. B. EROFEEV, N. I. KOBOSEV, A. BOGOJAVLENSKAJA, and K. PROSKURNINA (J. Phys. Chem. Russ., 1938, 12, 188—205, 206—226).—II. Reduction of Fe nitrides of a composition varying between $Fe_{2·03}N$ and $Fe_{4·15}N$ and partly containing Al_2O_3, K_2O, or Fe_2O_3 was measured between 220° and 300°. The rate showed a max. which was attained the more rapidly the higher was the temp. Deposition of Fe from $Fe(CO)_5$ on to the nitride increased the rate and caused the disappearance of the max. From the change of the reaction velocity with time the mechanism of the reaction was deduced; the majority of the hydrogenations started on crystal edges, some on crystal corners, and one on crystal faces.

III. From the above data the activity of the primary reaction centres and the rate of expansion of the reaction into the bulk of crystals were calc. J. J. B.

Kinetics of topochemical reactions. S. Z. ROGINSKI (J. Phys. Chem. Russ., 1938, 12, 427—444; cf. A., 1938, 529).—Taking account of the discontinuity of crystal growth, new reaction velocity equations have been deduced, and criteria established for crystallisation and chemical effects in topochemical reactions. For many of the topochemical reactions so far studied the energy of activation, E, is approx. zero. The larger is E, the more important is the rôle of chemical factors. Data for the decomp. of solid permanganates show the importance of the deforming power of the cation in the topochemical decomp. of salts of complex acids. R. C.

Rate of crystallisation as a criterion of purity of organic compounds. J. MICHEL (Bull. Soc. chim. Belg., 1939, 48, 105—157).—The rate of crystallisation of a supercooled liquid on seeding $\propto$ the nature of the substance and is useful for the identification and determination of purity of org. compounds and for the differentiation of polymorphic forms. Ultrafiltration merely increases the extent to which supercooling is possible. Of 57 substances examined, 36 gave reproducible results. Impurities reduce the rate, the influence being greatest at a temp. corresponding with max. rate of crystallisation of the pure substance. The presence of >20% of impurity increases the no. of centres of crystallisation on seeding. Difficulties are encountered with mixtures of isomorphous substances. The influence of constitution is discussed; the more symmetrical is the mol. the greater is the rate of crystallisation. F. H.

Influence of high pressures on propagation of reactions in explosive solids.—See B., 1939, 782.

Combustion of explosives.—See B., 1939, 781.

Rate of propagation of combustion in a bomb. —See B., 1939, 685.

Determination of catalytic effect of traces of substances. P. G. POPOV (Trans. Inst. Chem. Charkov Univ., 1938, 4, No. 13, 145—158).—$MnSO_4$ and $K_2S_2O_8$ yield purple $KMnO_4$ solution in presence, and brown MnO_2 suspension in absence, of traces of Ag. R. T.

Catalytic decomposition of hydrogen peroxide in presence of ferric citrate. M. M. BOBTELSKY and B. KIRSON (Compt. rend., 1939, 208, 1577—1579).—The decomp. of H_2O_2 (followed by O_2 evolution) in presence of $Fe_2(SO_4)_3$ and Na citrate (I) is studied. With $[Fe^{\cdots}]/[C_6H_5O_7''']$ = 5—10, (I) enhances the catalytic effect of $Fe^{\cdots}$, decomp. occurring rapidly without an induction period. Higher (I) concns. retard decomp. and cause marked induction periods, which are greater in the absence of light. A. J. E. W.

Catalytic properties of sulphuric acid and sulphates. I. Hydrolysis of ethyl acetate in presence of sulphuric acid. W. WYCZAŁKOWSKA (Rocz. Chem., 1939, 19, 347—354).—The velocity coeff. of the reaction of hydrolysis of EtOAc in presence of H_2SO_4 agrees with that calc. on the assumption that the catalyst is $H^{\cdot}$, and that H_2SO_4 is totally dissociated. The lower vals. obtained with HCl or $HClO_4$, which are also completely dissociated, do not invalidate this view, the result being ascribed to the retarding effect of Cl' or ClO_4'. R. T.

Lecture demonstration of catalysis in homogeneous and heterogeneous systems. A. KRAUSE

(Rocz. Chem., 1939, **19**, 365—370).—The catalytic action of $Fe^{...}$, $FeO(OH)_2$, $Cu^{..}$, $Cu(OH)_2$, $Co^{...}$, or $Co(OH)_2$ is demonstrated by the reaction between indigo-carmine and H_2O_2.   R. T.

Surface-active substances in contact catalysis. V. BERTLEFF (Chem.-Ztg., 1939, **63**, 409—412, 441—442).—A review.

Relation between catalytic activity and size of particle. E. W. THIELE (Ind. Eng. Chem., 1939, **31**, 916—920).—Mathematical. For any given grain size of a porous catalyst the ratio (actual activity)/(activity corresponding with infinitely small grain size) is determined by a dimensionless modulus, vals. of which are compared for cases in which the catalyst is in spheres or flat plates, and the reaction is of first or second order and involves no vol. change or an increase or decrease of vol.   F. L. U.

Kinetics of reactions in which solids participate. IV. Thermal decomposition of mercuric oxide. B. V. EROFEEV and K. I. TRUSOVA (J. Phys. Chem. Russ., 1938, **12**, 346—360; cf. A., 1939, I, 423).—The decomp. at 400—500° is autocatalysed by the Hg formed, apparently through this being adsorbed on the surface of the HgO and creating a configuration facilitating reaction; Hg added to the system has no catalytic action. Different samples of Hg vary considerably in reactivity. Reaction starts on the edges of the crystals, but is often complicated by sintering. The energy of activation of the decomp. is 57,500 g.-cal.   R. C.

Catalysts for synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. IV. Catalysts prepared by the roasting method. S. TSUTSUMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 47—52).—Co catalysts with ThO_2, U_3O_8, or MnO as promoter have been prepared by mixing the nitrate solutions with kieselguhr, evaporating, and roasting below 300°. After reduction with H_2 the rate of contraction of a mixture of CO and H_2 was measured by passing it over the heated catalyst. The optimum reduction temp. of these catalysts is lower than for those prepared by pptn., but they are not so active unless a large amount of kieselguhr is added. The differences between catalysts prepared by roasting and by pptn. is the smaller the larger is the mol. wt. of the promoter. (Cf. B., 1939, 803.)   T. H. G.

[Catalytic] **synthesis of benzine from carbon monoxide and hydrogen under ordinary pressure.** —See B., 1939, 688.

[Catalytic] **conversion of carbon monoxide under increased pressure [with steam].**—See B., 1939, 685.

Effect of support on sintering of catalysts. I. E. ADADUROV and N. A. PROZOROVSKI (J. Phys. Chem. Russ., 1938, **12**, 445—450).—Examination of the hydrogenation of C_2H_4 catalysed by Ni supported on sulphates of bivalent metals has shown that the greater is the radius of the cation of the support the smaller is the tendency of the catalyst to sintering and the greater is its activity. With an oxide of a quadrivalent metal as support, the activity is greater and the tendency to sintering smaller than with a sul-phate of a bivalent metal as support. SnO_2 and $MgSO_4$ both produce the max. tendency to sintering and the min. activity.   R. C.

Copper as catalyst for hydrogenation of benzene.—See B., 1939, 689.

Catalytic activity of intermetallic compounds in the gas-phase reduction of nitrobenzene. O. W. BROWN, J. E. BORLAND, R. A. JOHNSTON, and R. C. GRILLS (J. Physical Chem., 1939, **43**, 805—807).—The vapour-phase reduction of $PhNO_2$ to $(\cdot NPh)_2$ and NH_2Ph in the presence of Tl_2Pb and of Tl_3Bi has been investigated. The effect of various additions of one metal to the compound is studied. Tl_2Pb behaves more like Pb than like Tl; Tl_3Bi is less active than either Tl or Bi.   W. R. A.

Effect of internal field and polarisability of molecule on energy of activation. I. E. ADADUROV and E. G. SEDASHEVA (J. Phys. Chem. Russ., 1938, **12**, 455—459).—Examination of the rate of catalysed hydrogenation of o- and p-$C_6H_4Me\cdot NO_2$ in the vapour phase has shown that the larger is the Kerr const. of the substrate the smaller is the energy of activation.   R. C.

Cathode phenomena in the electrolysis of aqueous solutions of alkali salts or hydroxides. R. PIONTELLI (Gazzetta, 1939, **69**, 221—237).—The mechanism of the cathode discharge process during the electrolysis of solutions of $Na^{\cdot}$ ions is discussed. The direct discharge of $Na^{\cdot}$ ions probably occurs only at Hg and Pb cathodes. In general, the primary process consists in the loss of H by a hydrated $Na^{\cdot}$ ion present in the cathode double layer.   O. J. W.

Potentiometric investigations on the cathodic deposition of copper in presence of iron salts. M. GELOSO and P. DESCHAMPS (Bull. Soc. chim., 1939, [v], **6**, 1100—1112).—At const. temp., c.d., rate of agitation, and electrode area there is a definite concn. of Fe salt below which Cu will deposit completely. At higher [Fe] the Cu deposits and is subsequently re-dissolved. This crit. concn. of Fe is lowered by increase in temp. or in rate of agitation. Potentiometric measurements made with and without a separation of the cathodic and anodic compartments show irregularities due to cathodic formation of $Fe^{..}$ and anodic production of $Fe^{...}$, the extent of each reaction being dependent on the temp. and rate of diffusion. The potential of dissolution of Cu indicates that the cathodic re-dissolution in presence of Fe is probably due to the reaction $Cu + 2Fe^{...} = Cu^{..} + 2Fe^{..}$.   J. W. S.

Electrolytic manufacture of perchloric acid from sodium chlorate.—See B., 1939, 739.

Electrodeposition of silver–lead alloys.—See B., 1939, 735.

Action of inorganic colloids on electrodeposition of nickel.—See B., 1939, 735.

Separation of isotopic molecules in a direct-current glow discharge. W. GROTH and P. HARTECK (Naturwiss., 1939, **27**, 390—391).—During the passage of a d.c. discharge pressure differences are set up between anode and cathode which result in separation of gas mixtures. The method has been

used in an attempt to separate Xe isotopes, but, with the apparatus used, no separation could be detected. Some separation was, however, found with other gases which were diat. Separation to a small extent was effected with H_2 and D_2. Even smaller effects would be found with other gases, as the difference between the at. wts. of the isotopes is relatively smaller, although this may be compensated for by the smaller diffusion consts. of the heavier mols.

A. J. M.

Photochemistry of heavy-metal azides. I. Structure and properties of gelatin suspensions of heavy-metal azides. S. M. MOSKOVITSCH (J. Phys. Chem. Russ., 1938, **12**, 460—467).—The shape and size of the grains of suspensions of AgN_3 and $Pb(N_3)_2$ have been examined and the developability of the latent image produced by exposure to light has been demonstrated. In a first ripening of a suspension of $Pb(N_3)_2$ the surface area of the grains increases, but in a second ripening this ceases. R. C.

Mechanism of development. I. General effect of oxidation products on the development process and the nature of the induction period. T. H. JAMES (J. Physical Chem., 1939, **43**, 701—719).—A new apparatus and technique for developing in the absence of O_2 are described. For all developing agents which possess a negative charge on the active ion there is an induction period which increases with the negative charge, but there is no induction period when the uncharged mol. is the active agent. Before a negative ion can produce reduction it must penetrate a potential barrier due to adsorbed halide ion. This gives rise to the induction period and implies that the chemical reaction takes place at or very near the surface of the grain. The action of a high concn. of various substances was found to be in agreement with the effect of these substances on the ζ potential of the Ag halide grain. The oxidation products of org. developers increase the rate of development when the active part of the developing agent consists of bivalent ions but decreases the rate with those agents which are active as univalent ions or neutral mols. This decrease is particularly marked with members of the p-$C_6H_4(NH_2)_2$ series but as the p_H is increased the development rate for the compounds increases also, owing, presumably, to an increased rate of destruction of the oxidation products formed. W. R. A.

Effect of ultra-violet light on built-up multi-layers. V. J. SCHAEFER (Science, 1939, **89**, 465—466).—A multilayer of acid Ba stearate (I) [Ba stearate (III) + stearic acid (II)] deposited on Cr-plated steel to a thickness which shows interference colours changes in colour after a short exposure to ultra-violet light. The apparent thickness of the multilayer decreases. Similarly, a colourless film on suitable glass shows bright interference colours on irradiation. A multilayer of pure (II) undergoes a similar change in apparent thickness, but is not skeletonised like (I). Pure (III) shows a much smaller loss. By irradiating a film at 0° the photochemical effect can be separated from the subsequent evaporation of the volatile constituent. $\lambda\lambda$ between 2300 A. and 2700 A. are responsible for most of the photochemical decomp.

Light of shorter $\lambda\lambda$ also decomposes layers of (I). Comparison of the rate of evaporation of the volatile products formed by irradiation with that of $C_{10}H_{22}$, $C_{14}H_{30}$, and $C_{16}H_{34}$ indicates that ultra-violet light splits the mols. of (II) at the CO_2H group. Absorption of effective radiation by a 700-layer film of (I) reduces the effective radiation by 13%. L. S. T.

Photochemical investigations in the Schumann ultra-violet. VIII. Photochemical decomposition of ethane. K. FALTINGS (Ber., 1939, **72**, [*B*], 1207—1215; cf. A., 1938, I, 631).—Extinction coeffs. of C_2H_6 for the Xe resonance lines $\lambda\lambda$ 1470 and 1295 A. were measured. The decomp. products are chiefly H_2, C_2H_4, and C_2H_2, with smaller amounts of CH_4, C_3H_8, and C_4H_{10}. At 1 atm. the quantum yields for H_2, C_2H_2, and C_2H_4 are respectively 1, 0·2, and 0·56 mol. A mixture of C_2H_6 and CO containing 80% of CO gives $COMe_2$ as the main product, with a quantum yield of 0·1, and only a small amount of CH_2O. The results are best explained by regarding the primary reaction as $C_2H_6 + h\nu = 2Me$, after which the main products are formed as follows : $2Me = C_2H_4 + H_2$; $2Me = C_2H_2 + 2H_2$; $2Me + CO = COMe_2$. F. L. U.

Reactivity of lower hydrocarbons. VIII. Mercury-sensitised reactions of methane, deuteromethanes, and the isotopes of hydrogen (exchange reaction). IX. Mercury-sensitised reactions of methane, deuteromethanes, and the isotopes of hydrogen (condensation reaction). K. MORIKAWA (J. Soc. Chem. Ind. Japan, 1939, **42**, 133—136B, 136—139B ; cf. A., 1939, I, 59).—VIII. The progress of the exchange reactions $D_2 + CH_4$, $CH_4 + CD_4$, and $CD_4 + H_2$ was followed by measuring the absorption of sp. $\lambda\lambda$ in the infra-red region, from which the % of C·D linkings and the proportions of the various deuteromethanes present in the mixtures were obtained. All three reactions are very similar in all respects but the first is the most rapid. The proportions of the various deuteromethanes vary with temp. The reactions proceed by chain mechanisms which also vary with temp.

IX. CH_4 condenses to yield higher hydrocarbons and H_2 without change of pressure under the influence of Hg resonance radiation at fairly low temp., but as the temp. rises small amounts of olefines are produced. The rate of condensation increases with rise of temp. but its extent decreases. Its rate is less in the presence of H_2 or D_2, the former causing the greater depression. A possible mechanism is suggested.

T. H. G.

Kinetics of destruction of tyrosine combined in the egg-albumin molecule by ultra-violet radiant energy. F. W. BERNHART and L. E. ARNOW (J. Physical Chem., 1939, **43**, 733—736).—Ovalbumin solutions of adjusted p_H were irradiated in quartz tubes by a Hg arc and the liberated tyrosine (I) was determined. The order of the reaction is not 0, 1, or 2. By assuming that destruction of protein-combined (I) takes place as a first-order reaction and that, as a result of irradiation, other substances in ovalbumin decompose to yield, by a zero-order process, (I) or a phenol, vals. for the amount of (I) liberated have been calc. and are in good agreement with observed vals.

W. R. A.

Splitting proteins by ultra-violet light. D. C. CARPENTER (Science, 1939, 89, 251).—Monolayers of benzyl- or β-phenylethyl-stearylamine on N-HCl are photolysed by filtered ultra-violet light of λ 2480 and 2537 A. The peptide chains of proteins may thus be expected to split at places where light-absorbing side-chains occur in the mol. L. S. T.

Detonation of nitrogen iodide by nuclear fission. E. FEENBERG (Physical Rev., 1939, [ii], 55, 980—981).—NI_3 mixed with U_3O_8 and exposed to a Ra–Bo neutron source for 1 min.—several hr. gave times for spontaneous detonation by a factor of ~20 > in the case of unexposed control samples. Pure NI_3 was unaffected by the source. Data indicate 1200 fissions per detonation or an efficiency of 0·1%. N. M. B.

Intermediate states in solid reactions : active oxides. G. HÜTTIG (J. Chim. phys., 1939, 36, 84—98).—A survey and discussion of recent work (cf. A., 1938, I, 578 and previous abstracts). F. L. U.

Polyborates. I. Alkali borates. A. FERRARI and A. MAGNANI. **II. Tetra-alkylammonium borates.** A. FERRARI and G. PARETI (Gazzetta, 1939, 69, 275—284, 284—290).—I. The prep. of a no. of polyborates of K, Rb, Cs, and NH_4 is described. They can be represented by the general formula $M_2B_{2n}O_{3n+1}$,$(n + 2)H_2O$.
II. Tetraborates of NMe_4 and NEt_4 could not be prepared. The prep. of *decaborates* of NMe_4, NMe_3Et, NMe_2Et_2, $NMeEt_3$, and NEt_4, corresponding with the general formula $[NR_4]_2B_{10}O_{16}$,4 or $5H_2O$, is described. With $5H_2O$ this formula agrees with that mentioned above. Solubility data at 16° for some of these decarborates are given. O. J. W.

Copper fluorides. H. VON WARTENBERG (Z. anorg. Chem., 1939, 241, 381—394).—Anhyd. CuF_2 may be obtained by dehydration of $CuF_2,5HF,5H_2O$ at 400° in a stream of HF. It is white, transparent, mono- or tri-clinic, and melts at 950±5°, with some dissociation. It dissolves slowly in H_2O, the solubility at 20° being 4·7 g. per 100 g. Its heat of formation is 129·4 kg.-cal. per g.-mol. On melting it loses F_2, forming red CuF, and in presence of Cu the equilibrium in the melt corresponds with 60—80% CuF. On cooling (even the most rapid chilling) the CuF breaks up into CuF_2 and Cu, but in one experiment, which could not be reproduced, a transparent red solid solution of CuF in CuF_2 was obtained. Even on chilling the vapour the product is CuF_2 coloured red by very finely-divided Cu, but the action of HF on CuCl at approx. 650° affords on cooling a eutectic containing approx. 8% of CuF which cannot be separated from the CuCl. Even below the m.p. CuF_2 contains traces of CuF, and traces of H_2O in HF may be detected and removed by passage over CuF_2 at 600°, for H_2O reacts irreversibly with the CuF present, forming Cu_2O. F. J. G.

Dehydration of the double magnesium potassium sulphate. (MME.) N. DEMASSIEUX and B. FEDOROFF (Compt. rend., 1939, 208, 1581—1583; cf. A., 1939, I, 383).—Hydrates with $4H_2O$ (stable at 90—120°) and $2H_2O$ (148—155°) and the anhyd. salt (>175°) are obtained by progressive heating of $K_2Mg(SO_4)_2,6H_2O$; Debye–Scherrer diagrams are given. A tetrahydrate, which is exceptional, is also given by $K_2Fe(SO_4)_2,6H_2O$. Analogous structures occur in each of the series of anhyd. K double sulphates stable at low temp. (Cu, Co, Ni, Mg) and at higher temp. (Cu, Mg). Debye–Scherrer diagrams indicate production of a monohydrate and the anhyd. salt on heating $MgSO_4,7H_2O$ and the dehydration curve shows the existence of hydrates with 6, 2·5, 2, and $0·5H_2O$. A. J. E. W.

Action of bromine on the anhydrous oxides of the metals in the second column of the periodic classification table. P. PIERRON (Bull. Soc. chim., 1939, [v], 6, 1054—1056).—Br_2 vapour is absorbed slowly by MgO and CaO with formation of $MgOBr_2$ and $CaOBr_2$, respectively. These are fairly stable orange-coloured compounds which lose only ~10% of their Br during 3 days in a desiccator in presence of KOH. $CaOBr_2$ reddens in presence of H_2O but is only slowly decomposed at 90°. When SrO is treated with Br_2 the $SrOBr_2$ is partly decomposed with loss of O_2 and formation of $Sr(BrO_3)_2$ and $SrBr_2$. BaO yields only $BaBr_2$ and $Ba(BrO_3)_2$. J. W. S.

Quantitative measurement of the natural rate of growth of calcite crystals in geodes. L. T. PATTON (Science, 1939, 89, 485).—Crystals of calcite 1·0—2·5 mm. long and 1·0 to 1·5 mm. thick have been formed in cavities of building stone in 10 years. L. S. T.

Action of bromine on alkaline-earth hydroxides in aqueous solution. P. PIERRON (Bull. Soc. chim., 1939, [v], 6, 1051—1054).—Addition of Br to saturated aq. $Ba(OH)_2$ yields only $BaOBr_2,H_2O$, which in dil. solution or on treatment with Ag_2O dissociates into $Ba(OBr)_2$ and $BaBr_2$. With the less sol. $Ca(OH)_2$ only 95% of $CaOBr_2,H_2O$ is formed, whilst with $Sr(OH)_2$ only $Sr(OBr)_2$ and $SrBr_2$ are produced. J. W. S.

Action of bromine on mercuric oxide. P. PIERRON (Bull. Soc. chim., 1939, [v], 6, 1047—1051; cf. A., 1937, I, 473; 1938, I, 40).—The initial addition product $HgOBr_2$ decomposes under the action of Br, yielding $Hg(OBr)_2$ and $HgBr_2$. As the $Hg(OBr)_2$ is formed it reacts with further Br to re-form $HgOBr_2$ and Br_2O. Under conditions such that $Hg(OBr)_2$ is fairly stable (at low temp. and atm. pressure) the Br_2O oxidises further $Hg(OBr)_2$ to $Hg(BrO_3)_2$, but under conditions such that the $[Hg(OBr)_2]$ is very small (in a vac. or in contact with a solution of Br in CCl_4) the Br_2O is decomposed with liberation of O_2 and the final product is only $HgBr_2$. J. W. S.

Solubilities and separations in glasses. M. FOËX (Ann. Chim., 1939, [xi], 11, 359—452).—A review and discussion of work published by the author and others on solubilities of oxides in molten B_2O_3 and B_2O_3 glasses, appearance of a second phase caused by cooling or the addition of oxides, and the influence of the surrounding atm. on devitrification in SiO_2 glasses. F. L. U.

Aqueous corrosion of thallium. E. PLANK and A. URMÁNCZY (Z. anorg. Chem., 1939, 241, 416—417; cf. A., 1939, I, 381).—In an atm. of H_2, and in complete absence of O_2, H_2O or aq. TlOH has no corrosive action on Tl. F. J. G.

Conditions of formation and stability of carbonyls and complex cyanides. I. B. ORMONT (J. Phys. Chem. Russ., 1938, 12, 259—270).—The author's theory of co-ordination (cf. A., 1939, I, 61) is applied to carbonyls and complex cyanides. It explains why metals (e.g., Cr) giving very stable carbonyls produce rather unstable cyanides, and metals (e.g., Co) the carbonyls of which are less stable give rise to stable cyanides.   J. J. B.

Synthesis of quartz by pneumatolysis, using shattering explosives. Formation of liquid inclusions as mobile bubbles. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1939, 208, 1594—1595).—Cristobalite and spherolites of quartz have been synthesised by detonation of mixtures of hexogen with SiO_2 and H_2O or aq. KOH, respectively, followed by heating at 550° for six days under the pressure (>3000 kg. per sq. cm.) of the detonation products. The quartz was accompanied by a vitreous residue containing liquid inclusions similar to those found in granite, and the experimental conditions are probably similar to those of the genesis of granites. (Cf. A., 1939, 1, 432.)   A. J. E. W.

New halides of silicon. IV. Silicon chloride of formula SiCl. R. SCHWARZ and U. GREGOR (Z. anorg. Chem., 1939, 241, 395—415; cf. A., 1938, I, 208, 410).—Besides $(SiCl)_x$ the products of pyrolysis of $Si_{10}Cl_{20}H_2$ are $SiCl_4$, Si_2Cl_6, Si_3Cl_8, Si_4Cl_{10}, $SiHCl_3$, HCl, and H_2. $(SiCl)_x$ is a yellow amorphous solid. At 180—200° it undergoes a reversible colour-change to orange-red, and it is stable up to approx. 500°, when it breaks up into Si and saturated Si chlorides. It is stable in dry O_2 at room temp., but burns at 98°, and it inflames spontaneously in NO_2, forming Si and SiO_2. It is rapidly hydrolysed by H_2O, and is insol. in org. solvents or in $SiCl_4$. It reduces ammoniacal $AgNO_3$ to Ag, and with HNO_3, after a short time or on gentle warming, it explodes. It inflames with liquid Br, but with Br vapour at 0° it reacts quietly to form a complex mixture of unsaturated Si–Cl–Br compounds and $SiCl_4$. The reaction with Cl_2 is less violent but equally indefinite. With NH_3 at 0°, ammonolysis occurs, the products being H_2, NH_4Cl, and compounds $Si_6(NH_2)_8$ and $Si_8(NH_2)_{10}$. At −25° the reaction is similar but an additive compound, $Si_8(NH_2)_{10},18NH_3$, results. Controlled hydrolysis with moist Et_2O at −20° affords a red compound, $(SiOH)_x$, and at room temp., with evolution of H_2, a yellow compound, $Si_4(OH)_6$. This last is also formed by the action of conc. HCl. $(SiCl)_x$ must be regarded as a highly-polymerised and unsaturated long-chain compound, presumably with alternating double and single bonds.   F. J. G.

Action of water on glass.—See B., 1939, 719.

Stability and solubility of sodium stannate. F. REIFF and S. M. TOUSSAINT (Z. anorg. Chem., 1939, 241, 372—380).—$Na_2Sn(OH)_6$ always contains small amounts of NaOH which cannot be removed by washing, and it is therefore very sensitive to CO_2, but in the absence of CO_2 it is quite stable either as solid or in solution at <50°. At >50° in solution some deposition of $Sn(OH)_4$ occurs. Its solubility in H_2O and in solutions of NaOH, Na_2CO_3, and other Na salts has been determined at 0—120°. In H_2O the solubility is >500 g. per l. at 0°, and decreases markedly with rising temp. Na_2CO_3 lowers the solubility markedly, but the shape of the curve is unchanged. Other Na salts also lower the solubility to varying extents. NaOH lowers the solubility very markedly and the shape of the curve is different, the solubility at first decreasing with rising temp., but then increasing after passing through a min. which shifts to lower temp. with increasing [NaOH].   F. J. G.

Determination of the mol. wt. of lead by the Richards–Hönigschmid method. II. Preparation of pure lead chloride. V. M. PERMJAKOV (J. Gen. Chem. Russ., 1939, 9, 381—385).—Pure $PbCl_2$ containing traces of Mg and Ca is prepared by distillation in a stream of HCl.   R. T.

Existence, properties and crystal structure of $Pb^{IV}P_2O_7$. G. PEYRONEL (Gazzetta, 1939, 69, 254—262).—PbP_2O_7 is obtained in good yield by the action of H_3PO_4 on PbO_2 at 300°. It is insol. in H_2O and in acids, but may react slowly with the latter, especially if reducing agents are present; in conc. alkali solutions it is completely sol., and can be determined by addition of KI, NaOAc, and AcOH, and titration of the liberated I. PbP_2O_7 is gradually decomposed at 400—500°, and it is isomorphous with other compounds $M^{IV}P_2O_7$ (cf. A., 1936, 669); space-group T_h^6, 4 mols. in cell, a 8·01±0·01 A., $d_{calc.}$ 4·935.   O. J. W.

Affinity. LXXXVIII. System vanadium–sulphur. W. BILTZ and A. KÖCHER (Z. anorg. Chem., 1939, 241, 324—337).—The system has been studied by means of cooling curves and X-rays, and the existence of VS and V_2S_3 confirmed, but that of V_2S_5 disproved. The highest sulphide is a tetrasulphide, VS_4, which is formed as a black powder when V_2S_3 is heated with S at 400°, and excess of S removed by means of CS_2. It is to be identified with the mineral patronite (A., 1907, ii, 788). Its heat of formation from V_2S_3 and S is 5 kg.-cal. per g.-mol., and its dissociation pressure becomes 1 atm. at 460°. It dissolves completely in warm NaOH with a characteristic red colour. It is sol. in fused S, and such solutions after being heated at ≯400° deposit VS_4 on cooling, but after being heated at >500° they deposit V_2S_3. VS has the NiAs structure with a 3·34, c 5·785 A., $c/a = 1·73$.   F. J. G.

Formation of ozone by heating persulphate solutions containing sulphuric acid in its dependence on the concentration of acid and in presence of cellulose. F. ULLRICH (J. pr. Chem., 1939, [ii], 153, 91—115).—The course of the decomp. of KSO_4 in solutions with varying H_2SO_4 content during boiling for 5 min. is followed by determination of O_3 evolved and KSO_4 remaining. The possibility that O_3 is due in part to the decomp. of H_2SO_5 is strengthened by the similarity of the graphs showing the relationship between HSO_5 and yield of O_3 on [H_2SO_4]. Passage of air through the boiling solutions increases appreciably the yield of O_3, the rapid removal of which diminishes the tendency to secondary reduction. In presence of cellulose (filter-paper or bleached cotton tissue) there is increased formation of O_3. Under identical conditions the reaction $2KSO_4 + H_2O_2 = 2KHSO_4 + O_2$ is almost

complete after boiling for 5 min.; this explains the observation that H_2O_2 cannot be detected in the solutions until HSO_4 has disappeared. Since also the amount of H_2SO_5 in the boiled solution does not increase until HSO_4 is no longer present, it appears that a similar change may occur between KSO_4 and H_2SO_5. H. W.

Preparation of the dihydrate $MoO_3,2H_2O$, and its cryoscopy in aqueous solution. (MLLE.) M. MURGIER and Y. DOUCET (Compt. rend., 1939, **208**, 1585—1586; cf. A., 1906, ii, 762; 1926, 1219).— $MoO_3,2H_2O$ crystallises on keeping from the solution obtained by adding cold HNO_3 (d 1·18) to an equal vol. of 15% aq. NH_4 molybdate at 70°. Addition of NH_4NO_3 is undesirable. Vals. of the cryoscopic ratio θ/m ($m = 0·0024$—0·03 g.-mol. per l.) are identical with those for sol. molybdic acid (A., 1939, I, 262), the solutions containing $H_2Mo_4O_{13}$. A. J. E. W.

Volatilisation of metallic compounds from solutions in perchloric or sulphuric acid. J. I. HOFFMAN and G. E. F. LUNDELL (J. Res. Nat. Bur. Stand., 1939, **22**, 465—470).—Results are recorded on the extent of volatilisation of metallic compounds at 200—220° from solutions in $HClO_4$, $HClO_4 + H_3PO_4$, or H_2SO_4, in presence of HCl or HBr. The following can be quantitatively distilled from $HClO_4$: As, Sb, Ge, Cr, Os, Ru, Re, and Sn; and the following from H_2SO_4: As, Sb, Se, Ge, Re, and Sn. Partial loss of other metals, e.g., Bi, Au, Mo, Te, Tl, may occur. F. J. G.

Affinity. LXXXIX. Cobalt phosphides. W. BILTZ and M. HEIMBRECHT (Z. anorg. Chem., 1939, **241**, 249—360).—The system Co–P has been studied by means of cooling curves, tensimeter curves, and X-rays. Of the various phosphides recorded in the lit. only Co_2P and CoP exist, but there is also a *triphosphide*, CoP_3. From the dissociation pressures, the heat of formation of CoP_3 from CoP is 30 kg.-cal. per g.-mol., and that of CoP from Co_2P is 9 kg.-cal. per g.-mol. CoP_3 is isomorphous with NiP_3 (A., 1938, I, 313), but Co_2P is not isomorphous with Ni_2P. Data on ρ for Co–P preps. are recorded. The mol. vols. of Co_2P, CoP, and CoP_3 are 10·3, 14·2, and 35·7, respectively. F. J. G.

Preparation and properties of the hexagonal form of nickel. G. LE CLERC and A. MICHEL (Compt. rend., 1939, **208**, 1583—1585; cf. A., 1931, 1217).— A form of Ni having a compact hexagonal structure (a 2·65, c 4·32 A., c/a 1·63) is obtained on heating the cubic form in CO at 170° for several days. This form is non-ferromagnetic; on heating at >250° the cubic form, with normal magnetic properties, is produced. Transformation into the cubic form is accompanied by absorption of heat and a vol. contraction of 5·4%, in agreement with the at. vols. (13·1 and 11 cu. A.). Cubic Ni is metastable at room temp. A. J. E. W.

Palladium carbide. N. G. SCHMAHL (Congr. int. Quim. pura apl., 1934, **9**, III, 468—473; Chem. Zentr., 1936, ii, 4200—4201).—The action of CH_4 or CH_4–H_2 mixtures (at 750°) on Pd, prepared by reduction of PdO with H_2, ceases as soon as the solid contains 4·4% of C, corresponding with the compound Pd_5C_2. The product has the same capacity for H adsorption as Pd; its X-ray diagram permits a tetragonal structure, which is probably of the double interstitial type. A. J. E. W.

Spectrographic analysis.—See B., 1939, 733.

Hydrogen-ion activity and buffer capacity of natural and treated waters. A. P. BLACK and E. BARTOW (Ind. Eng. Chem. [Anal.], 1939, **11**, 261—264).—The effect of the method of prep. of quinhydrone (I), the use of (I) reference electrodes, and the effect of buffer capacity of waters on determination of p_H vals. have been investigated. Purity of (I) is essential, especially when working with weakly buffered solutions. (I) of satisfactory quality can be prepared using Fe^{III} alum (cf. A., 1927, 221, 533), and by Valeur's method (A., 1901, i, 154). Vals. for p_H of different waters obtained with the (I) electrode are consistently lower than corr. colorimetric vals. For an accuracy of 0·1 p_H unit, the (I) electrode can be used with waters of fairly high alkalinity (~300 p.p.m.) up to p_H 7·5, but is not suitable for waters of low alkalinity (<100 p.p.m.) above p_H 7·0. L. S. T.

Fluorescent indicators. II. K. A. JENSEN (Z. anal. Chem., 1939, **117**, 50—51; cf. A., 1933, 1132).— The p_H ranges over which changes in the intensity of fluorescence of β-methylumbelliferone derivatives are observed are as follows: 8-chloro- 5—7, 8-bromo- 5—7, 6 : 8-dichloro- 4—6, and 3 : 6 : 8-trichloro-7-hydroxy-4-methylcoumarin 3—5. 3 : 5 : 8-Trichloro-6 : 7-dihydroxy-4-methylcoumarin shows scarcely any fluorescence but undergoes a colour change from colourless to yellow at p_H 3—5, corresponding with the change from a deep blue to a light green fluorescence observed with 6 : 7-dihydroxy-4-methylcoumarin at p_H 9—10. Coumarin derivatives act as indicators only when there is a free OH present. J. W. S.

Screened methyl-orange. R. F. INNES (Analyst, 1939, **64**, 419—420).—A sample of xylene-cyanol FF failed to act satisfactorily at the specified concn., but acted at double this concn. E. C. S.

Determination of water in silicates. C. O. HARVEY (Bull. Geol. Survey, Gt. Britain, 1939, No. 1, 8—12).—The sample (~2 g.) in a Pt boat is placed in a SiO_2 test tube and heated over a Meker burner. A weighing bottle containing 4—5 g. of carbonated $CaCl_2$ fits over the open end of this tube and absorbs the H_2O evolved. Details of procedure, test data, and comparative results obtained by the SiO_2 combustion tube method are recorded. L. S. T.

Possibility of supercooling heavy water and its mixtures with ordinary water. L. STARONKA (Rocz. Chem., 1939, **19**, 317—322).—The stability of supercooled liquid H_2O at −20° is > of 99·9% D_2O. That of 45% D_2O = that of H_2O, and of 10% D_2O is > of H_2O. 0·01% of D_2O can be detected in H_2O by measurement of the time during which H_2O remains liquid at −20°. R. T.

Determination of moisture in brown coals.— See B., 1939, 682.

Determination of iodine in " airol."—See B., 1939, 775.

Determination of hydrofluoric acid and of "uncombined" acid in alkali and ammonium fluorides. J. H. VAN DER MEULEN (Chem. Weekblad, 1939, **36**, 476).—Free HF in "neutral" alkali metal or NH_4 salts is determined by boiling with neutral $CaCl_2$ solution and determining the liberated HCl titrimetrically with $0.2N$-NaOH (Me-orange or Me-red) or iodometrically after adding KI and KIO_3 solutions. In the latter case the pptd. CaF_2 tends to adsorb I and starch. S. C.

Determination of oxygen in air. O. ISHIZAKA (J. Pharm. Soc. Japan, 1938, **58**, 60—61).—Using the apparatus designed for determining CO_2 with alkaline pyrogallol, the O_2 content is found to be 22.6—23 vols.-%. H. B.

Gravimetric determination of sulphur in cast iron and steel.—See B., 1939, 726.

Pregl sulphur combustion of metallic compounds.—See A., 1939, II, 397.

Determination of hydrogen sulphide in commercial gases.—See B., 1939, 716.

Detection of toxic gases and vapours in industry.—See B., 1939, 782.

Ferrous dimethylglyoxime oxidation–reduction indicator in the titration of hyposulphites with ferricyanide. G. CHARLOT (Bull. Soc. chim., 1939, [v], **6**, 977—979).—A drop of $0.02N$-$FeCl_3$ and 4—5 drops of dimethylglyoxime solution (saturated in EtOH) are diluted to 100 c.c. and buffered to p_H ~9.4 by addition of conc. aq. NH_3 (7 c.c.) and NH_4Cl (5 g.). The solution to be titrated is added and the $K_3Fe(CN)_6$ is run in until the colour changes from red to pale yellow. The colour change is reversible, being sharp for $0.1N$. solutions, whilst $0.02N$. solutions can be used. There is no correction for oxidation of the indicator, but as the change point of the indicator is at 0.25 v. and that of the oxidation reaction is at 0.09 v., there is a tendency to add a drop too much $K_3Fe(CN)_6$. The titration is best conducted in an atm. of N_2 to avoid oxidation. J. W. S.

Conductometric determination of selenious acid with silver ion. R. RIPAN-TILICI (Z. anal. Chem., 1939, **117**, 47—49).—The solution is neutralised to p_H 9 with $0.5M$-aq. $NaHCO_3$ before titrating conductometrically with $0.5M$-$AgNO_3$. Data are recorded for the titration of 0.01—$0.0025M$-Na_2SeO_3. J. W. S.

Qualitative separations on a micro-scale. Analysis of the tellurium and copper groups of A. A. Noyes and W. C. Bray. B. S. ALSTODT and A. A. BENEDETTI-PICHLER (Ind. Eng. Chem. [Anal.], 1939, **11**, 294—298; cf. A., 1939, I, 217).—The mg. procedure detailed for these groups retains the essential features of the Noyes–Bray scheme, and provides for the isolation, confirmation, and estimation of 10 μg. of any member of the groups in presence of 500 μg. of any other member. Te is confirmed as lemon-yellow hexagons and triangles of Cs_2TeCl_6, Mo by the blue colour of the residue from the Et_2O extract, the red coloration with CNS′ and Zn, and the black ppt. of MoS_3, Ir as reddish-brown crosses and octahedra with $(CH_2)_6N_4$, Rh as the red coloration obtained with $SnCl_2$, Pb as $K_2PbCu(NO_2)_6$ or $PbCrO_4$, Bi as $Cs_3Bi_2I_9$, and Cu as Cu Hg thiocyanate. L. S. T.

Thermal conductivities of some binary gas mixtures. F. ISHIKAWA and K. HIJIKATA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 401—415).—An investigation of the applicability of a heat conductivity method of gas analysis to chemical problems. The variation of conductivity with pressure up to 1 atm. has been measured for N_2, H_2, and CO, and for the binary mixtures N_2–H_2 and CO–H_2. The compositions of mixtures can be determined with an error of $<0.1\%$. The experimental technique consists in using a conductivity wire as one arm of a Wheatstone bridge and measuring the voltage (which is $\propto$ current) necessary to keep the temp. of the wire const. T. H. G.

Volumetric determination of phosphoric acid on the basis of the method of N. von Lorenz with the use of reversed filtration. Working up the molybdenum residues. L. GISIGER (Z. anal. Chem., 1939, **117**, 17—24; cf. A., 1939, I, 97).—To recover the Mo from the filtrates obtained after pptn. of PO_4''' the solution (80 l.) is treated with conc. aq. NH_3 (23—25 l.) during 4.5—6 hr. with continuous stirring, after which the mixture is kept for 24 hr. The clear solution is decanted off and the ppt. freed from mother-liquor by suction and finally by washing with H_2O. After determination of the NH_4 and Mo contents, the residue is used for prep. of fresh reagent solution. Titration residues can be dissolved in aq. NH_3 and the PO_4''' pptd. with the theoretical amount of $Mg(NO_3)_2$. The solution is then worked up with the filtrates from the pptn. process. J. W. S.

Micro-determination of carbon in steel.—See B., 1939, 729.

Analysis of minerals from Canali Serci. N. COLLARI (Period. Min., 1936, **7**, 179—185; Chem. Zentr., 1936, ii, 1510).—Analytical processes are described. A. J. E. W.

Determination of potassium and the potassium content of normal voluntary muscle.—See A., 1939, III, 735.

Semi-direct determination of potassium oxide in felspars.—See B., 1939, 720.

Systematic synthesis of atomic groups in analytical chemistry. VII. Reactions and formation of salts of 1-phenyl-3-methyl-5-pyrazolone and of oximino-ψ-thiohydantoin. J. V. DUBSKÝ (Pub. Fac. Sci. Univ. Masaryk, 1939, No. 271, 15 pp.).—The greyish-white Ag salt, the pale reddish-brown Ag^{II} salt, the inner complex Cu salt, the Fe'', Co'', and the corresponding diol-cobalti-salts of 1-phenyl-3-methyl-5-pyrazolone, and the inner complex Ag, Cd, Co, Pb, Cu, and Ni salts of oximino-ψ-thiohydantoin of the general formula $(C_3HN_3SO_2)M^{II},(OH_2)_x$ are described. With Ba'' and Ca'', only the complex diol-salts of the type $[(C_3H_2N_3SO_2)Ba(OH)]_2(H_2O)_x$ could be prepared. L. S. T.

Systematic synthesis of atomic groups in analytical chemistry. V. Reactions of the group S:C·NH·C: with specific affinity for silver. J. V. DUBSKÝ and V. ČERNÁK (Pub. Fac. Sci. Univ. Masaryk, 1939, No. 269, 20 pp.; cf. A., 1939, I, 217).—Investigation of the reactions of 2-thiohydantoin and its condensation products with numerous aldehydes etc. with salts shows a selective reaction not only with Ag and Hg salts but also with those of Pb and Cu. This is attributed to the presence of the second NH. Noteworthy reactions are : 2-thiohydantoin–NO·C_6H_4·NHPh, Ag˙ violet-red ppt. (0·2 μg.), Hg˙ red ppt. (0·4 μg.), Cu˙˙ dark-blue ppt. (0·6 μg.); 2-thiohydantoin–p-NMe$_2$·C_6H_4·CHO, Ag˙ red-orange ppt. (0·9 μg.), Hg˙ vermilion-red ppt. (0·5 μg.), Hg˙˙ carmine-red ppt. (0·2 μg.); 2-thiohydantoin–NO·C_6H_4·NMe$_2$, Ag˙ violet ppt. (1·2 μg.), Hg˙, blue ppt. (0·2 μg.), Hg˙˙ blue ppt. (0·5 μg.), and Cu˙˙ black-violet ppt. (0·158 μg.). Limiting sensitivities are given in parentheses. L. S. T.

Qualitative analysis without hydrogen sulphide. C. J. BROCKMAN (J. Chem. Educ., 1939, 16, 133—138).—Ag, Pb, and Hg^I are pptd. as usual, and Ba, Sr, Ca, and Pb as sulphates with dil. H_2SO_4 and EtOH. Sn, Al, Sb, Zn, Cr, and As are extracted from the filtrate by treatment with KOH and Na_2O_2, and the insol. hydroxides dissolved in acid. Mn, Fe, Bi, and Mg are pptd. as phosphates by neutralising this solution with $(NH_4)_2CO_3$ and adding aq. NH_3 and $(NH_4)_2HPO_4$. The filtrate contains complex NH_4 salts of Cu, Hg, Co, Ni, and Cd. Details of these separations and of those in the groups are given. L. S. T.

Analysis of glass.—See B., 1939, 719.

Potentiometric determination of zinc. D. G. STURGES (Ind. Eng. Chem. [Anal.], 1939, 11, 267—268).—Zn can be determined with a precision equal to that obtained with indicators by adding an excess of aq. $K_4Fe(CN)_6$, and back-titrating the excess potentiometrically with aq. $Ce(SO_4)_2$, using a Pt–W electrode pair. The titration should be carried out at room temp., and the mixed solutions kept for 15 min. before titrating. Addition of $K_4Fe(CN)_6$ to a hot solution containing Zn˙˙ should be avoided owing to decomp. HCl decreases the inflexion potential sufficiently to make an end-point difficult to obtain. NH_4Cl has no effect; free HCl should be neutralised with aq. NH_3, and the solution acidified up to ≯2N. with H_2SO_4. $KMnO_4$ can be substituted for $Ce(SO_4)_2$ when the [Zn] is ≯30 mg. per 100 ml. L. S. T.

Determination of traces of zinc in biological material and natural waters. N. L. ALLPORT and C. D. B. MOON (Analyst, 1939, 64, 395—402).—Traces of Zn are extracted from aq. liquids with dithizone in $CHCl_3$ in presence of m-$C_6H_4(OH)_2$. A method for separating large quantities of heavy metals as sulphides without adsorption of Zn is described. The procedure for determining Zn colorimetrically is detailed, the test being of sufficient sensitivity that small samples of biological material are required and the preliminary evaporation of

large vol. of H_2O is obviated. Of the commonly occurring metals only Ni and Co interfere.
E. C. S.

Analytical applications of dimine (cyclohexylethylamine dithiocarbamate). (MME.) M. HERRMANN-GURFINKEL (Bull. Soc. chim. Belg., 1939, 48, 94—103).—0·5% aq. dimine (C_6H_{11}·NEt·CS·S·NH$_2$Et·C_6H_{11}) (I) yields white ppts. with Pb, Hg^{II}, As^{III}, As^V, Sb^{III}, and Zn; yellowish-white with Cd and Sb^V; yellow with Ag, Bi, and Sn^{IV}; brown with Cu, Fe^{II}, Fe^{III}, and Mn^{II}; green with Ni and Co; grey-black with Hg^I, and brick-red with UO_2˙˙. With Sn^{II} the ppt. is white in neutral solution and yellow in acid solution. With MoO_4″ in neutral solution the reagent gives a yellow ppt., but this turns red in acid solution or on addition of Al˙˙˙, and becomes brownish-rose in presence of Zn˙˙ or Bi˙˙˙. The limits of sensitivity of the method for detection of these metals are recorded. In absence of other metals pptd. by (I), Cu and Fe can be determined by pptn. with a 10—50% excess of aq. (I), the ppt. being separated, washed with dil. aq. (I), ignited, and weighed as CuO or Fe_2O_3. Fe^{III} can be separated from Cr by pptn. with aq. (I) from a solution 0·05N. in HCl. J. W. S.

Determination of lead in steel.—See B., 1939, 729.

Iodometric determination of copper in nitric acid solution. S. K. HAGEN (Z. anal. Chem., 1939, 117, 26—30).—The sample containing ∼0·2 g. of Cu is dissolved in 10 c.c. of dil. HNO_3 and the solution is boiled until no further brown fumes are evolved. 10 c.c. of diluent solution {$Pb(NO_3)_2$ 1·5 g., $CO(NH_2)_2$ 100 g., and a little HNO_3 per l.} are added and the solution is shaken vigorously and cooled to room temp. It is then treated with 10 c.c. of aq. KCNS (10%) and 10 c.c. of aq. KI (1%) and titrated immediately with 0·1N-$Na_2S_2O_3$. J. W. S.

Separation and determination of copper and nickel by salicylaldoxime. Effect of hydrogen-ion concentration. L. P. BIELFELD and D. E. HOWE (Ind. Eng. Chem. [Anal.], 1939, 11, 251—253).—The effect of p_H on the pptn. of Cu˙˙ and Ni˙˙ by salicylaldoxime (I) has been investigated for pure solutions and for mixtures containing Cu + Ni, and Cu + Fe. The Cu–(I) complex starts to ppt. quantitatively from pure solutions at p_H 2·6, and the Ni complex at 7·0. The Ni complex starts to ppt. at p_H 3·3. The p_H range of separation of Cu from Ni is 2·6—3·1. Entrainment of the Ni complex by Cu is very small at p_H 3·1, even with a ratio of Ni : Cu = 20 : 1. Entrainment of the Fe–(I) complex occurs over a wide range of p_H, and is probably not due solely to adsorption. The amount decreases with a rise in p_H. (I) is a suitable reagent for the determination of Cu in certain alloys. Determinations of Ni by means of (I) or dimethylglyoxime have the same precision, but the former reagent affords a more rapid method and gives a ppt. that is easier to handle. L. S. T.

Reactions of aminophenols with copper and iron.—See A., 1939, II, 314.

Colorimetric determination of small quantities of copper in medicinal preparations.—See B., 1939, 775.

Ceriometric determination of copper in Paris-green and ores.—See B., 1939, 761.

[Determination of] traces of copper in gasoline.—See B., 1939, 688.

Tetraphenylarsonium chloride as an analytical reagent. Determination of mercury, tin, cadmium, and zinc. H. H. WILLARD and G. M. SMITH (Ind. Eng. Chem. [Anal.], 1939, **11**, 269—274; cf. A., 1939, I, 336).—The determination of Hg depends on the reaction $2AsPh_4^{\cdot} + HgCl_4'' \rightarrow [AsPh_4]_2HgCl_4$, which is white, cryst., sol. in H_2O, but insol. in aq. NaCl. $Hg^{\cdot\cdot}$ (0·5—100 mg.) is pptd. by $AsPh_4Cl$ (I) in 30—120 ml. of 1—2·5M-NaCl, and the excess of (I) titrated potentiometrically with I. In pure solutions, the error is ~±0·06 mg. of Hg. A gravimetric determination is not possible as no suitable wash-liquid has been found. Free acid (0·2—1·0M.), except HNO_3, does not interfere, but MnO_4', ReO_4', ClO_4', IO_4', I', Br', F', WO_4'', MoO_4'', CrO_4'', CNS', $Bi^{\cdot\cdot\cdot}$, $Pt^{\cdots}$, $Sn^{\cdots}$, $Zn^{\cdot\cdot}$, $Cd^{\cdot\cdot}$, $Tl^{\cdots}$, $Au^{\cdots}$, and ions which react with I' or I must be absent. Interference by $Cu^{\cdot\cdot}$, $Sn^{\cdots}$, $Mn^{\cdot\cdot}$, $Fe^{\cdots}$, and $Ti^{\cdots}$ can be overcome by the formation of suitable complexes. $Sn^{\cdots}$ (0·80—84·0 mg.) in a vol. of 30—120 ml. can be determined by pptn. as $[AsPh_4]_2SnCl_6$ and potentiometric titration of the excess of reagent with I, or titration of the dissolved ppt. The ppt. should be formed in 0·4—2·0M-HCl and 1·5—3·0M-NaCl. $Fe^{\cdots}$, >25 mg. of Fe, $Pt^{\cdots}$, $Au^{\cdots}$, $Bi^{\cdots}$, $Hg^{\cdot\cdot}$, $Cd^{\cdot\cdot}$, $Zn^{\cdot\cdot}$, $Sb^{\cdots}$, $Tl^{\cdots}$, $As^{\cdots}$, $UO_2^{\cdot\cdot}$, F', C_2O_4'', PO_4''', OAc', and anions pptd. by (I) must be absent. The error is ≯±0·06 mg. of Sn. Cd and Zn can be determined by procedures similar to the above. The ppts. of $[AsPh_4]_2CdCl_4$ and $[AsPh_4]_2ZnCl_4$ are more sol. than the compounds formed with $Hg^{\cdot\cdot}$ and $Sn^{\cdots}$. Pptn. should be effected in 3·0—3·5M-NaCl and ≯0·4M-HCl. The same interferences occur as with Hg and Sn, and $Cu^{\cdot\cdot}$, $Co^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, and $Fe^{\cdots}$ interfere more seriously. Interference by small [$Sn^{\cdots}$] can be avoided by the addition of tartrate. Data showing the effects of different ions on these determinations are recorded. The effects of variation in the conditions of pptn. are also detailed.   L. S. T.

New organic qualitative reagents. J. W. SMITH and H. E. ROGERS (J. Chem. Educ., 1939, **16**, 143—144).—The colours obtained by pptg. Hg^{I}, Ag, Pb, Sb^{III}, Sn^{II}, Ca, Ba, and Sr as carbonate, sulphate, or hydroxide in presence of Bordeaux-red (I), brilliant-violet, brilliant-yellow (II), brilliant-green, phloxine, pyronin, phenosafranine, fluorescein, alizarin-red S, naphthol-yellow, erythrosin, ponceau 2R, Bismarck-brown B, and Hoffmann-violet 3R are recorded. With (II) $Ag^{\cdot}$ pptd. as Ag_2SO_4 gives a characteristic, orange-coloured ppt. With (I), $Sb^{\cdots}$, pptd. by aq. NH_3, gives a characteristic pink ppt., and a pink solution with 0·001 g. of Sb per ml.; $Sn^{\cdot\cdot}$ gives a white ppt. HCl solutions of $Sb^{\cdots}$ and $Sn^{\cdots}$ have no effect on the colour of the dye, but those of $Sn^{\cdot\cdot}$ discharge it immediately. $Ca^{\cdot\cdot}$, pptd. as $Ca(OH)_2$ in presence of (II), gives a pink ppt., whilst $Ba^{\cdot\cdot}$ and $Sr^{\cdot\cdot}$ give orange-coloured ppts. and solutions.   L. S. T.

Detection and determination of small amounts of cerium with ferrous o-phenanthroline. G. CHARLOT (Bull. Soc. chim., 1939, [v], **6**, 1126—1127).—The oxidation–reduction indicator solution is prepared by dissolving o-phenanthroline (3 mols.) and $FeSO_4$ (1 mol.) in H_2O to yield a solution 0·025M. in $(C_{12}H_8N_2)_3Fe^{\cdot\cdot}$. The solid under test, or its solution in H_2SO_4, is warmed with $(NH_4)_2SO_4$ and Na bismuthate (I) until gas is evolved freely. After filtering a drop of the indicator is added. In absence of Ce the solution is coloured red, but in its presence it turns pale blue. MnO_4', Cr_2O_7'', and VO_3' also oxidise the indicator and interfere with the test. Cl', if present, must be removed by boiling with an excess of (I). The test permits the detection of 0·2—0·3 mg. of Ce in 100 c.c. of solution. Small amounts of Ce can be determined by oxidation to Ce^{IV} with (I) and titration with 0·005M-indicator solutions until a rose colour develops. A blank test should be made with (I) alone to confirm its purity.   J. W. S.

Separation and determination of aluminium and beryllium using tannin. M. L. NICHOLS and J. M. SCHEMPF (Ind. Eng. Chem. [Anal.], 1939, **11**, 278—280).—Investigation of the effect of [NH_4OAc] on the pptn. of Al and Be hydroxides shows that the addition of NH_4OAc raises the pptn. p_H of the solution above that at which the hydroxides normally start to ppt. in the cold, and that Be probably forms a more stable complex with acetate than does Al, and is not so readily or completely hydrolysed. The addition of tannin (I) to these solutions followed by boiling gives heavy ppts. with Al when the p_H is >3·39, and a slight opalescence with Be at p_H 4·66, which increases as the p_H is raised. With Be, the formation of the (I) complex is not compatible with the view (A., 1927, 846) that $Be(OH)_2$ forms a sol. complex with NH_4OAc and (I); further, freshly-pptd. $Be(OH)_2$ is not dissolved (loc. cit.) to form a clear solution when treated with a 3% solution of (I) in saturated aq. NH_4OAc. Data given for the effect of p_H, (I) concn., and digestion time show that recovery of Al is complete at p_H 4·6±0·1, with a (hot) digestion time of ≯1 hr. after addition of (I), that the amount of (I) should be ≯12—15 times the wt. of Al_2O_3, and that the ppts. dried at 110° do not suffer a const. percentage loss on ignition at 1200—1300°. The Be ppt. does not require digestion. Details for the separation and determination of Al and Be based on the above findings are given, and test data recorded. Contrary to the statement of Moser et al. (loc. cit.), the presence of Cl' does not prevent the separation of Al from Be by this method.   L. S. T.

Colorimetric determination of manganese with periodate. J. P. MEHLIG (Ind. Eng. Chem. [Anal.], 1939, **11**, 274—277).—Spectrophotometric investigation shows that this method (A., 1918, ii, 84) is satisfactory with few limitations. H_2SO_4, HNO_3, or H_3PO_4 may be present in widely varying concns., and a large excess of periodate may be used. Beer's law is obeyed, and the colour is stable in diffused light for ≯2 months. Of the 56 ions the effect of which has been studied, only a few which are coloured interfere seriously with the determination. When $Ba^{\cdot\cdot}$, $Pb^{\cdot\cdot}$, $Ca^{\cdot\cdot}$, or $Sr^{\cdot\cdot}$ is present, H_3PO_4 should replace

H_2SO_4. The colour due to $Fe^{\cdots}$ is satisfactorily removed by H_3PO_4. Bi and Sn^{II} should be removed owing to the insolubility of their periodates in solutions of high acid concn.   L. S. T.

Oxidation–reduction indicators. G. CHARLOT (Bull. Soc. chim., 1939, [v], 6, 970—977).—$Fe^{\cdot\cdot}$ dimethylglyoxime is a reversible and very sensitive oxidation–reduction indicator, which can be used with advantage in ammoniacal solution. At p_H 9·4 the change occurs at +0·025v., this val. being influenced to only a negligible extent by the concn. of reactants. The colour change depends on the fact that the Fe^{II} complex is so unstable that it is oxidised at the same potential as $Fe^{\cdot\cdot}$ ions; no oxidation of the dimethylglyoxime itself occurs. Sulphosalicylic acid, pyrocatechol, 8-hydroxyquinoline, and pyramidone all give coloured products with $Fe^{\cdots}$, which can act as oxidation–reduction indicators in acid solution owing to reduction of Fe^{III} to Fe^{II}, but the colours produced by interaction of $Fe^{\cdots}$ with thioglycollic acid and $CH_2\!:\!N\cdot OH$ in alkaline solution are discharged irreversibly on reduction, owing to decomp. of the org. compounds.   J. W. S.

Titrations with a tellurium electrode. S. DE BROUWER (Bull. Soc. chim. Belg., 1939, 48, 158—163).—A Te electrode the surface of which has been freed from grease and lightly rubbed with emery gives good results in the titration of mild oxidising agents such as CrO_4'' and OCl' provided adequate time is allowed for the attainment of equilibrium. Addition of TeO_2 and a stream of CO_2-free air during the titration are unnecessary.   F. H.

Control of the cyanogen bands of the graphite arc, when determining chromium spectrographically in plant material.—See A., 1939, III, 804.

Gravimetric determination of molybdenum as molybdenum trioxide. M. STRAUMANIS and B. OGRIŅŠ (Z. anal. Chem., 1939, 117, 30—47).—Incomplete pptn. of H_2O-sol. molybdates by H_2S is due to formation of Mo-blue and of sulphomolybdates and to the solubility of MoS_3 in acids. Pptn. is most complete when the molybdate concn. is $\not> 30$ mg. per 100 c.c. and the acid concn. 0·02—0·1N. AsO_4''', PO_4''', and strong oxidising agents must be absent. H_2S is passed briskly through the cold solution for 5—10 min., after which the solution is boiled for 10 min. with the H_2S still passing, cooled, and filtered. The ppt. is heated gently at first and finally ignited at 500° for 15 min. and weighed as MoO_3. Under these conditions the results are only ~0·5% too low.   J. W. S.

Potentiometric determination of molybdenum in ferromolybdenum.—See B., 1939, 729.

Rapid quantitative spectrum analysis of ores, particularly for determination of tin.—See B., 1939, 731.

Photometric determination of vanadium in steel.—See B., 1939, 729.

Determination of antimony in ores and concentration products.—See B., 1939, 731.

Volumetric semi-micro-determination of antimony in white metals.—See B., 1939, 731.

Separation of tantalum and niobium. H. WIRTZ (Z. anal. Chem., 1939, 117, 6—9).—The mixture of Ta_2O_5 and Nb_2O_5 (~0·8 g.) is weighed into a porcelain crucible and fused with $KHSO_4$ (~10 g.). The product is dissolved in warm 5% $(NH_4)_2C_2O_4$ (~100 c.c.) and the solution is diluted to 400 c.c. A few drops of bromophenol-blue solution and 1—2 c.c. of conc. H_2SO_4 are added, and after boiling dil. aq. NH_3 is added slowly until the colour becomes distinctly purple. The Ta and Ti, together with a small amount of Nb, are then pptd. by addition of 2% aq. tannin, to which 10 g. of NH_4Cl has been added. The mixture is boiled for 20—30 min., the vol. being maintained at 400 c.c., after which the ppt. is collected, washed with hot 2% NH_4Cl, and ignited. The Nb pptd. with the Ta is determined by reduction with amalgamated Zn, followed by titration with $KMnO_4$, either after addition of $Fe_2(SO_4)_3$ or in an atm. of CO_2, and is deducted from the total wt. of residue. The removal of most of the Nb by the tannin separation minimises error owing to inaccuracies in the titration of this element. Provided that the p_H is correctly adjusted before pptn. only 0·01 g. of Nb_2O_5 is pptd. If Ti is present or is added to facilitate the titration its oxidation from Ti^{III} to Ti^{IV} must be allowed for.   J. W. S.

Determination of gold in cyanide plating solutions.—See B., 1939, 736.

Development and problems in liquid thermometry. W. GRUNDMANN (Glas u. Appar., 1936, 17, 137—139, 147—148, 159—160, 169—171, 179—180; Chem. Zentr., 1936, ii, 4239; cf. A., 1938, I, 476).—The choice of a dye for colourless liquids, and difficulties due to changes in the glass, are reviewed. The Six thermometer and the properties of the creosote oil used in its construction are studied in detail. Pure Hg can be supercooled 2·5—3° or more in a Six thermometer.   A. J. E. W.

Thermo-regulator and relay assembly. D. GREIFF (Science, 1939, 89, 468).—An arrangement giving a temp. control varying $< \pm 0·05°$ over a continuous run of 3 months is described.   L. S. T.

Comparative investigation of the usual and the adiabatic methods of determining the heat capacity of solids at low temperatures. N. FEODOSIEV (J. Phys. Chem. Russ., 1938, 12, 291—307).—Adiabatic and non-adiabatic measurements of the c_p of an empty calorimeter agree, but c_p of KCl appears smaller in the adiabatic method. This is presumably due to the slow reaching of the temp. equilibrium in the badly conducting KCl, which impairs the non-adiabatic method. Vals. are recorded for c_p of KCl between $-190°$ and 25°.   J. J. B.

High-temperature vacuum calorimeter of the copper block type. L. G. CARPENTER and A. R. BRYANT (J. Sci. Instr., 1939, 16, 183—192).—A precision calorimeter in which the Cu block may be at any temp. $\not> 500°$ and the specimen at any temp. $\not> 1000°$ is described. The whole apparatus is

enclosed in an evacuated vessel. Random errors in the determination of the sp. heat are $\not> 0\cdot3\%$.

D. F. R.

Micro-apparatus for temperature–time curves, and a high-temperature thermostat. W. E. L. BROWN (J. Sci. Instr., 1939, **16**, 195—199).—The thermopile consists of 8 differential Pt–(Pt–13% Rh) thermocouples, one set of junctions being in contact with 0·1 g. of alloy in a SiO_2 tube. It is enclosed in a thermostatic furnace, the windings of which form a resistance thermometer circuit.

D. F. R.

Registering microphotometer. C. S. BEALS (Month. Not. Roy. Astr. Soc., 1936, **96**, 730—736; Chem. Zentr., 1936, ii, 4145).—Simultaneous recording of the unknown and two comparison spectra is effected with three independent photo-cell-galvanometer systems. A. J. E. W.

Devices for visual comparison of spectrograms. G. E. DAVIS (Science, 1939, **89**, 229—230).

L. S. T.

Refraction method for obtaining photographic records of concentration gradients. K. J. I. ANDERSSON (Nature, 1939, **143**, 720—721).—A method for obtaining photographic records of n gradients in a column of solution, e.g., in a centrifuge cell, is described and compared with Philpot's method (A., 1938, I, 215). L. S. T.

Direct determination of crystal structure from X-ray data. M. AVRAMI (Z. Krist., 1939, **100**, 381—393; cf. A., 1938, I, 559).—A detailed mathematical account of work reported. In the procedure, designed to obviate phase difficulties of the " trial and fluke " method in crystal analysis, the experimental relations of at. scattering factors are applied to obtain a simplified system of equations, procedures for solving which are indicated. The method, illustrated from the known KH_2PO_4 structure, has advantages over that of Patterson (A., 1935, 1193). I. McA.

Magnetic electron microscope of high resolving power. A. PREBUS and J. HILLIER (Canad. J. Res., 1939, **17**, A, 49—63).—The development of the electron ultramicroscope, its resolving power, and its applications are discussed. An instrument capable of resolution to 200 A. is described. J. W. S.

Effect of chromatic error on the electron-microscope image. J. HILLIER (Canad. J. Res., 1939, **17**, A, 64—69).—By photo-micrometer methods it has been shown that, owing to chromatic error, the intensity-distribution in the image of the edge of a diatom obtained with an electron ultramicroscope has a max. just outside and a min. just inside the image of the edge of the absorbing object. It is suggested that the intensity-distribution curve can be used in physical analysis. J. W. S.

Semi-automatic, multiple, electrometric titration apparatus. M. E. STANSBY and G. A. FITZGERALD (Ind. Eng. Chem. [Anal.], 1939, **11**, 290—293).—An arrangement by means of which 10 electrometric titrations can be carried out simultaneously by one operator within a time little > that required for a single titration is described. The burettes are controlled by solenoids, and the progress of titration is followed by a series of coloured lights on a control panel. The apparatus is designed primarily for fish-freshness titrations, but can be used for a wide range of potentiometric work. L. S. T.

Low-resistance glass electrode. W. C. JOHNSON (Chem. and Ind., 1939, 573—574).—The electrode consists of a bundle of glass tubes (diameter ~1 mm., thickness 0·05—0·1 mm.) sealed at one end, and cemented together near their open ends. The bundle is sealed into a glass adaptor. Low resistance is thus achieved by increasing the glass surface. A convenient form of Hg_2Cl_2 half element for use with this and other glass electrodes is described. L. S. T.

Scientific foundations of polarography. M. VON STACKELBERG (Z. Elektrochem., 1939, **45**, 466—491).—A comprehensive account of the electrochemical principles affecting the dropping Hg electrode and its numerous applications as an analytical method.

J. A. K.

Potentiometer for measuring voltages of 10 microvolts to an accuracy of 0·01 microvolt. R. P. TEELE and S. SCHUHMANN (J. Res. Nat. Bur. Stand., 1939, **22**, 431—439).—Special arrangements for eliminating extraneous thermal p.d. are described.

F. J. G.

Wilson cloud chamber with several expansions per second. H. BRINKMAN (Physica, 1939, **6**, 519—528).—The gas in a disc-shaped chamber is alternately compressed and expanded by a piston at 0·7—20 cycles per sec., non-turbulent radial motion being secured by means of a baffle plate. During each compression the ions are removed by an electric field. L. J. J.

Cathode-ray tube unit. ANON. (J. Sci. Instr., 1939, **16**, 199—200).—The unit has a deflexion sensitivity of 0·18 mm. per v. for the x-plates and 0·28 mm. per v. for the y-plates and is suitable for use at all frequencies up to those corresponding with ultra-short radio waves. D. F. R.

Chemical studies by means of molecular beams. VII. Measurement of atomic beams of potassium by means of an incandescent tungsten surface. I. K. KODERA (Bull. Chem. Soc. Japan, 1939, **14**, 114—121).—Taylor's method (A., 1929, 1212) has been adapted by using a narrow ribbon of W instead of wire. The ions are ejected by electrical flashing and measured by a ballistic galvanometer. The efficiency of the method has been studied.

T. H. G.

Accurate pipette calibrator and micro-aspirator. E. E. OSGOOD, A. H. OSGOOD, and E. S. WEST (Amer. J. clin. Path., Tech. Suppl., 1939, **3**, 128—133). C. J. C. B.

Glass helices for packing laboratory fractionating columns. R. W. PRICE and W. C. McDERMOTT (Ind. Eng. Chem. [Anal.], 1939, **11**, 289—290).—Apparatus and method for making uniform spirals up to 35 cm. long from Pyrex glass rod are described. L. S. T.

Laboratory columns for close fractionation. Conical type of Stedman packing. L. B. BRAGG (Ind. Eng. Chem. [Anal.], 1939, **11**, 283—287).—Further developments of the Stedman type of packing

in three sizes are described. Efficiency test-data for a mixture of C_6H_6 and $C_2H_4Cl_2$ are recorded. Efficiency is highest at low rates of distillation; a max. is reached at a point below which efficiency decreases rapidly with further reduction in the rate.
                        L. S. T.

Determination of interfacial tension by measurement of equilibrium rotation surfaces. H. FLOOD and H. WERGELAND (Kong. Norske Vidensk. Selsk. Forh., 1936, **8**, 125—127; Chem. Zentr., 1936, ii, 4101).—The interfacial tension is deduced from the form of a drop of liquid in a horizontal tube full of the second liquid, and in rapid rotation about its axis.   A. J. E. W.

Gasoline-torch laboratory burner. J. J. LYNCH (Science, 1939, **89**, 230).   L. S. T.

Anti-foaming devices. R. SCHNURMANN (Ind. Eng. Chem. [Anal.], 1939, **11**, 287—288).—Of two methods of destroying the large bubbles on the liquid surface, one applies an intermittent electric spark over the bubbles, and the other a weak jet of air or other gas across the mouth of the flask containing the foaming liquid. (Cf. B., 1939, 789.) L. S. T.

Mechanical stirrer. C. F. KREWSON (J. Chem. Educ., 1939, **16**, 138—139).   L. S. T.

Simple vibrator. J. F. VINCENT and M. M. SPRUIELL (Ind. Eng. Chem. [Anal.], 1939, **11**, 247).— A rotating glass stirrer with a rubber-covered projection is set at an angle and strikes the lower end of one of a series of absorption tubes.   L. S. T.

Apparatus for ultrafiltration. A. BAUDOUIN and J. LEWIN (Compt. rend. Soc. Biol., 1939, **130**, 599—602).—The apparatus, which may be sterilised and used at various temp., consists of a porous glass disc which supports the collodion membrane, the filtration being conducted under pressure.
                        H. G. R.

Liquid-flow regulator and its application to a constant-rate gas sampler. J. R. C. DUKE (J.S.C.I., 1939, **58**, 231—232).—A liquid-flow regulator which operates on the principle of the Edwards gas-regulating bottle has been devised. Small errors, due to displacement of Hg, have been eliminated by the insertion of a sintered-glass diaphragm which is permeable to H_2O but not to Hg. The regulator has been used in the construction of a const.-rate gas sampler.

Generator for air-free carbon dioxide (or hydrogen). S. H. TUCKER (Analyst, 1939, **64**, 410—415).—The construction of the apparatus, the prep. of air-free reagents, and the manipulation and testing of the generator are described.   E. C. S.

Technique of working with liquefied gases. V. A. PLESKOV (J. Phys. Chem. Russ., 1938, **12**, 255—258).—(1) A const. level for liquid NH_3 in a cryostat may be secured by placing electrodes below and just above the surface; when the current between these electrodes is interrupted another current which causes an addition of NH_3 is switched on. (2) A good filling for U-tubes for drying NH_3 etc. is obtained by wetting glass splinters with a solution of K in NH_3 and boiling off NH_3. (3) An extraction apparatus for liquid NH_3 is described.   J. J. B.

Simple apparatus for demonstrating Boyle's law. E. E. HAYS and R. G. GUSTAVSON (J. Chem. Educ., 1939, **16**, 115).   L. S. T.

Apparatus for holding funnels while filtering into beakers. E. SWIFT, jun. (J. Chem. Educ., 1939, **16**, 120).—A small glass or metal hook bent to fit over the rim of a beaker holds the funnel securely against the side of the beaker.   L. S. T.

Uni-directional source of ultrasonic waves. J. GRUETZMACHER (Z. tech. Physik, 1936, **17**, 166—167; Chem. Zentr., 1936, ii, 932).—Internal reflexion of waves on one face of the piezo-electric crystal is effected by attaching an air reservoir; the available energy is thus conc. in one direction through the liquid medium.   A. J. E. W.

" Coleum Philosophorum " of Philipp Ulstad. E. R. ATKINSON and A. H. HUGHES (J. Chem. Educ., 1939, **16**, 103—107).—Historical.   L. S. T.

Methods of fire-making used by early man. W. N. WATSON (J. Chem. Educ., 1939, **16**, 107; cf. A., 1939, I, 225).—A correction.   L. S. T.

Geochemistry

Ocean water from various parts of the world. T. NISHIKAWA, T. OKUNO, M. MAEDA, and Y. OGATA (J. Soc. Chem. Ind. Japan, 1939, **42**, 71—72 B).— Analyses of sea-H_2O taken at different places and seasons are presented. Although the total concn. of salt is variable the proportions of the constituents are substantially const.   W. A. R.

Occurrence of boron in salt lakes of Aral–Kaspian region. I. B. FEIGELSON, M. G. VALJASCHKO, and A. G. BERGMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 244—247).—Data showing the B content of 64 lakes are tabulated.   L. S. T.

Metamorphism of the subterranean waters of Levshino. A. M. KUZNETZOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 248—253).—Waters differing in composition and mineralisation have been found at the same level. Waters of the same type also occur in rocks lithologically different. At a depth of 40—50 m., $CaCl_2$ and Mg brines with a high content of K, Br, and I are also found. The waters are classified into (i) $Ca(HCO_3)_2$ waters with mineralisation up to 0·5 g., (ii) $CaSO_4$ waters, 0·5—5·0 g., (iii) Na_2SO_4 waters, 5·0—25·0 g., and (iv) chloride waters with mineralisation >25 g. per l. Waters of lower zones contain H_2S ≯0·3400 g. per l. The temp. of the waters varies from 2° to 6°. Chemical analyses are recorded. Changes in composition in the solutions as dependent on mineralisation are discussed.   L. S. T.

Spectroscopic character of the thermæ of the Transilian Alatau (Tyan-Shan). I. P. KOVO-

CHATSKI and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 323—324).—Qual. analyses have been made of the dry residues of 16 springs of the Alma-arasan, Talgar, and Gorelnik groups. All contain Mo, which is also found in local minerals. The following elements have been recognised : Cu almost always; B, Fe, Al, Li, and Sr frequently; Pb and Zn occasionally. Ni is characteristic of the Talgar group.   T. H. G.

The Salinas grandes of Cordoba province [Argentina]. R. RIGAL (Bol. Acad. Nac. Cienc., 1938, **34**, 142—182).—A no. of specimens of the contents of salt lakes and deposits in the region have been analysed. The NaCl content varies from ·90·76 to 99·70%, and is accompanied by $CaSO_4$ and Na_2SO_4. Analyses of samples of salt from other Argentine, British, German, and Spanish sources are recorded.   F. R. G.

Garnet crystals from California. J. MURDOCH (J. Geol., 1939, **47**, 189—197).—Numerous large and well-developed crystals of almandite garnet occur in diorite boulders at the San Joaquin Valley, Cal. They are characterised by inclusions of felspar identical with that in the surrounding rock. They are either phenocrysts or were formed by replacement of the diorite shortly after its intrusion into a series of metamorphosed sediments.   L. S. T.

Gold, pyrite, and carbon in the Rand banket. M. S. FISHER (Bull. Inst. Min. Met., 1939, No. 414, 36 pp.).—On the basis of microscopical examination of sections of the Rand banket the manner of occurrence of the Au, C, pyrite and other sulphides is discussed; all appear to have been deposited from solution in a definite order. It is concluded that the conglomerates have been subjected to extensive hydrothermal action which has brought about various changes in the rocks and the minerals, and that the bulk of the Au was deposited at a late stage in these changes. Microscopical evidence is in accordance with the view that the Au was introduced hydrothermally, but it can also be reconciled fairly well with the assumptions of the modified placer theory which appears to account best for the geological data.   A. R. P.

Synthesis of anorthite by pneumatolysis using shattering explosives. A. MICHEL-LEVY and J. WYART (Compt. rend., 1939, **208**, 1030—1033; cf. A., 1939, I, 287).—Anorthite has been synthesised by detonation of a mixture of hexogen (1·5), SiO_2 (0·12), Al_2O_3 (0·05), and $CaCO_3$ (0·08 g.), followed by annealing at 510—560° for 4—7 days. Two specimens are illustrated and described, the effect of longer annealing at higher temp. being studied.   A. J. E. W.

Synthesis of quartz by pneumatolysis.—See A., 1939, I, 427.

Schluckenau nickel–copper ore. V. PŘIS-TOUPIL (Chem. Obzor, 1936, **11**, 42—46; Chem. Zentr., 1936, ii, 2875).—The ore (Ni 0·4—2·5, Cu 0·7—3·66%) is a diabase with included pyrrhotine, and can be worked up by flotation.   A. J. E. W.

Volcanic rocks from Turkana, Kenya Colony : their field occurrence. W. C. SMITH (Quart. J. Geol. Soc., 1938, **94**, 507—553).—The rocks described include rhyolites, trachytes, phonolites, tephrites, trachybasalts, basalts, basanites, and nephelinites. Five chemical analyses [M. H. HEY] of basalt lavas and lapilli from the Teleki and Likaiyu volcanoes are recorded.   L. S. T.

Ilmenite–hæmatite–magnetite relations in some emery ores. J. M. BRAY (Amer. Min., 1939, **24**, 162—170).—Ores from Naxos, Greece, from Whittles, Virginia, from Chester, Mass., from Macon Co., N. Carolina, and from Peekshill, N.Y., are described. The chief method of occurrence of hæmatite (I) and ilmenite (II) is in the form of unique exsolution intergrowths, indicating unusual conditions of crystallisation. (II) exsolves from (I) to sharp magnetite (III)–(I) boundaries, showing that (I) is primary and not a later replacement product of (III). Exsolution of (I) from corundum is also well-defined. The original solid solution varied in composition from dominant (I) to dominant (II).   L. S. T.

Rutile in the Dogger [of N.-E. Yorkshire]. R. H. RASTALL (Geol. Mag., 1939, **76**, 109—115; cf. A., 1939, I, 109).—The many different varieties of rutile (I), which show a wide range of colour including green, are described. Unlike the brookite and anatase, the (I) is never authigenic.   L. S. T.

Chemical and mineralogical study of a new titanium mineral from Nellore District. N. JAYARAMAN and K. R. KRISHNASWAMI (Quart. J. Geol. Soc., India, 1938, **10**, 97—108).—The magnetic black inclusions (photomicrographs reproduced) in the garnets of the schist complex of Nellore (cf. A., 1937, I, 270) consist of a mineral containing SiO_2 0·12, TiO_2 65·90, FeO 18·88, Fe_2O_3 15·27, total 100·17%; it is probably a member of the system $FeTiO_3$–TiO_2–Fe_3O_4. The mineral is sol. in cold, conc. HCl.   L. S. T.

Petrography of some S. Victoria Land rocks. D. STEWART, jun. (Amer. Min., 1939, **24**, 155—161).—The mineralogical compositions of numerous rocks from S. Victoria Land, Antarctica, are tabulated and discussed. The 15 intrusive rocks vary in composition from kalialaskite to meladiorite. Small quantities of cassiterite in a kalialaskite provide an uncommon feature.   L. S. T.

Germanium, gallium, and indium in Sardinian blendes. S. C. L. CAMBI and L. MALATESTA (Rend. Ist. Lomb. Sci. Lett., 1936, [ii], **69**, 369—374; Chem. Zentr., 1936, ii, 3645).—Montevecchio Zn blendes contain In 0·007—0·012 (0·035—0·08), Ge 0·009—0·016 (0·03—0·06), and Ga 0·015—0·03 (0·07—0·15%). Electrolytic residues gave the contents in parentheses.   A. J. E. W.

Arrangement of atoms in laurionite, PbOHCl. S. GOLDSZTAUB (Compt. rend., 1939, **208**, 1234—1236; cf. A., 1937, I, 334).—The co-ordinates of Pb (0·21, 0·088, 0·25), Cl (0·46, —0·174, 0·25), and OH (—0·16, 0·088, 0·25) are derived, using data from a Fourier analysis along the [010] axis. The structure consists of $Cl(PbOH)_2Cl$ layers parallel to the g^1 (010) cleavage; each Pb atom is surrounded by three Cl atoms (distances 3·13, 3·15) and three OH groups (2·64, 2·66 A.), the nearest Cl atom in the neighbouring layer being at a distance of 3·52 A.   A. J. E. W.

Density of the pure potash-felspar constituent in microcline, and its general chemical composition. E. ROTTENBACH (Zentr. Min., A, 1936, 23—239; Chem. Zentr., 1936, ii, 3894).—Microcline has d 2·557(9); it is an alkali felspar, but not a pure potash felspar.　　　　　　　　A. J. E. W.

X-Ray examination of some potash-soda-felspars. S. H. CHAO, D. L. SMARE, and W. H. TAYLOR (Min. Mag., 1939, **25**, 338—350).—The samples of microperthic felspars previously examined chemically, optically, and thermally (A., 1937, I, 269; 1938, I, 542) have been examined by X-ray methods. In their normal state, when showing the microperthic structure with a schiller reflexion, they consist of two closely related materials, one of potash-felspar being monoclinic, and the other of most of the soda-felspar being triclinic but different from ordinary albite. The heat-treated specimens show only a single structure. The cell dimensions vary with the amount of soda-felspar present.
　　　　　　　　L. J. S.

Existence of a monoclinic soda-felspar. T. ITO (Z. Krist., 1938, **100**, 297—307; cf. A., 1937, I, 383). —Analysis of oscillation, Sauter, and Weissenberg X-radiograms for moonstone from Korea refutes views that it is a submicroscopically twinned triclinic felspar or an intergrowth of triclinic albite with monoclinic orthoclase. It consists of sanidine submicroscopically intergrown with an isomorphous Na monoclinic felspar of which the cell elements (a 7·94, b 12·90, c 7·12 A., β 116°) account for the confusion with albite.　　　　　　　　I. McA.

Blue fluorescence of natural silicates in the ultra-violet, and experiments with synthetic silicate melts containing bivalent europium. H. HABERLANDT and A. KÖHLER (Naturwiss., 1939, **27**, 275).—Potash-felspar, potash-soda-felspar, and datolite ($KCaBSiO_5$) give a blue fluorescence in the filtered ultra-violet from a quartz Hg-vapour lamp. The phenomenon is ascribed to the presence of traces of Eu^{II}. This was verified by preparing synthetic silicates of the above composition with the addition of traces of Eu^{II}. $2·5 \times 10^{-4}$ g. of Eu^{II} per g. of synthetic felspar gives a fluorescence considerably brighter than that given by the natural product, or than that of a natural fluorite known to contain 10^{-4}—10^{-3} g. of Eu^{II} per g. A felspar with a standard [Eu^{II}] was used to determine the [Eu^{II}] of other minerals by visual comparison of the brightness of the filtered fluorescence emission. A potash-felspar from Echsenbach was found to contain 10^{-6} g. Eu^{II} per g. An improved photometric method of determining the brightness of the fluorescence was also used to determine traces of Eu^{II} ($\sim 10^{-9}$ g. per g. of mineral) in natural silicates. The use of fluorescence analysis of various felspars in the solution of geochemical and petrogenetic problems is also discussed.
　　　　　　　　A. J. M.

Luminescence in the mineral kingdom. M. DÉRIBÉRÉ (Ann. Chim. Analyt., 1939, [iii], **21**, 119—124, 145—152).—A review and bibliography.
　　　　　　　　A. R. Pe.

Identity of Inder ascharite and camsellite. T. N. AGAFONOVA and E. W. ISKÜLL (Compt. rend.

Acad. Sci. U.R.S.S., 1939, **22**, 325—326).—Inder ascharite has the same composition ($2MgO,B_2O_3,H_2O$) and the same n ($\alpha = 1·575 \pm 0·003$; β not measured; $\gamma = 1·649 \pm 0·003$) as camsellite, whilst X-ray powder photographs of both show the same glancing angles and relative intensities. The two minerals are therefore identical. Chemical composition and recorded physical properties suggested that szaibelyite is also identical with them but X-ray data are lacking. Although of similar composition Stassfurt ascharite has different optical properties.　　　T. H. G.

Synthesis of inderite. I. B. FEIGELSON, V. E. GRUSCHVITSKI, and T. V. KOROBOTSCHKINA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 242—243).—A solution of 210·3 g. of $Na_2B_4O_7,10H_2O$, 157·5 g. of $MgSO_4,7H_2O$, and 2632 g. of H_2O kept at 35° for 52 days gives a cryst. ppt. which, after washing with H_2O and EtOH, has the composition and optical properties of inderite, $2MgO,3B_2O_3,15H_2O$.
　　　　　　　　L. S. T.

Zunyite and zunyite rock of Karabas. K. I. ASTASCHENKO and V. A. MOLEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 327—330).—A mineral identified as zunyite, found in a vein enclosed in diaspore-sericite secondary quartzites, has SiO_2 25·53, TiO_2 0·62, Al_2O_3 57·42, Fe_2O_3 0·10, MnO traces, MgO 0·03, CaO 0·10, SrO 0·001, Na_2O 0·17, K_2O 0·11, P_2O_5 0·56, Cl 2·56, F 5·52, H_2O+ 10·03, H_2O- 0·12 %. It is colourless and in some specimens has very low birefringence (0·002) and straight extinction, but is isotropic in others; n 1·587—1·594 $\pm 0·002$. Goniometrically it appears to be cubic. T. H. G.

Dolomites and flints in the phosphatic shale formation of the Hodna (Constantine). L. CAYEUX (Compt. rend., 1939, **208**, 1541—1543).—The occurrence of dolomite and flints in association with phosphates is described, and conclusions are reached concerning the genesis of the deposits.　A. J. E. W.

Mineralogical nature of some North African minerals; X-ray study. L. ROYER (Compt. rend., 1939, **208**, 1591—1593).—Pisolites deposited from hot springs (95°), and from Carlsbad, are shown by X-ray examination to consist of aragonite. Specimens from cooler springs (63°) are composed of calcite. If a third polymorphic form of $CaCO_3$ occurs during formation of pisolites, this must undergo rapid transformation into aragonite or calcite. North African kieselguhrs consist of amorphous hydrated SiO_2; tridymite can be detected after heating at >1000°. SiO_2 in petrified wood occurs as quartz. Various forms of North African phosphates give apatite X-ray diagrams.　　　　　　　　A. J. E. W.

Heavy mineral assemblages of the Burma oilfields. S. KRISHNASWAMY (Quart. J. Geol. Soc., India, 1938, **10**, 109—121).—The more important heavy minerals are magnetite, ilmenite, hornblende, epidote, garnets, zircon, rutile, chloritoid, kyanite, sphene, tourmaline, staurolite, tremolite, zoisite, and glaucophane. The last six are accessory minerals. The Irrawadian series shows predominant hornblende, rutile, and zircon, whilst the Pegus series shows pre-

dominant garnets and epidote. Staurolite occurs in many samples; brookite and anatase are rare.   L. S. T.

Geology of Jamkhandi, Deccan. Y. T. APTE (Quart. J. Geol. Soc., India, 1938, **10**, 123—133).   L. S. T.

Geology of Vengurla Peta. B. G. DESHPANDE (Quart. J. Geol. Soc., India, 1938, **10**, 167—178).— Rocks and minerals of the Archaean group, the Kaladgi sediments, and the Deccan trap are described. Two chemical analyses of Vengurla granite-gneiss are recorded.   L. S. T.

Action of minerals on gold solutions. O. E. ZVJAGINTZEV and I. A. PAULSEN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **21**, 176—178).—The action of aq. $AuCl_3$ on PbS, FeS_2, chalcopyrite, sphalerite, and $FeAsS$, and of aq. $NaAuO_2$ on PbS, sphalerite, and FeS_2 has been studied and the reaction products have been analysed. Au is produced in all cases, and S in several. The geochemical significance of the reactions is discussed.   E. S. H.

Beryllium-bearing variety of allanite. T. IIMORI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 53—55).—A mineral with a pitch-black lustre has been found at Iisaka village, Daté County, Fukushima Prefecture. It exists in massive anhedral form and has a greenish-grey streak; ρ 3·67; hardness 5—6; weakly radioactive. Its composition is SiO_2 30·58, Al_2O_3 12·71, rare earths 23·94, ThO_2 0·26, ZrO_2 0·57, Fe_2O_3 5·74, FeO 10·81, MnO 2·05, BeO 2·49, CaO 8·20, UO_3 trace, H_2O+ 3·33%. It appears to be an allanite with a much higher Be content than usual. This may be the result of weathering, as Al_2O_3 and BeO usually survive the weathering of allanite.   T. H. G.

Intercalibration and comparison in two laboratories of measurements incident to the determination of the geologic ages of rocks. R. D. EVANS, C. GOODMAN, N. B. KEEVIL, A. C. LANE, and W. D. URRY (Physical Rev., 1939, [ii], **55**, 931—946).— Results based on the accumulation of He in igneous rocks showed disagreement with available data. A co-operative revision showed that the Ra determinations used in the previous He time scale were incorrect. Full revised data by the α–He method and the Rn– Th–He method are given and complete agreement is now obtained.   N. M. B.

Linarite in ore deposits of Kazakhstan. F. V. TSCHUCHROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 257—258).—Linarite (I) has been recognised in the deposits at Dzhezkazgan, Azhim, Berkar, and Manka. (I) from the first locality contains PbO 47·15, CuO 26·43, SO_3 20·70, H_2O 5·00, insol. residue (quartz) 1·22, total 100·50% [V. M. SENDEROVA], giving the formula $(Cu,Pb)SO_4,(Cu,Pb)(OH)_2$. Modes of occurrence and associated minerals are described.   L. S. T.

Mercury in barytes. A. A. SAUKOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 254—256).— The Hg contents, determined spectrographically and nephelometrically, of numerous deposits of barytes in the U.S.S.R. range from $1·9 \times 10^{-2}$ to $2·4 \times 10^{-5}\%$.

Evidence that Hg^I may be an isomorphic component of $BaSO_4$ is discussed.   L. S. T.

Chkalovite. V. I. GERASIMOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 259—263).—*Chkalovite* (I), ρ 2·662, hardness ~6, n_g 1·549, n_p 1·544, orthorhombic, occurs as white semi-transparent grains of vitreous lustre in the Lovozero alkaline massifs of the central part of the Kola peninsula. X-Ray diagrams and plane spacings are given. (I) is sol. in cold, dil. or conc. HCl or HNO_3, with separation of flaky SiO_2,nH_2O. The analysis [PEREVERZEVA] SiO_2 56·81, Fe_2O_3 0·30, FeO 0·12, BeO 12·67, CaO 0·37, Na_2O 28·93, K_2O 0·13, H_2O- 0·23, SO_3 0·22, total 99·78% indicates a formula $Na_2O,BeO,2SiO_2$. The modes of occurrence and accompanying minerals, many of which contain traces of Be, are described. L. S. T.

Alkaline earth. I. K. KAWASE, H. KA, and K. KAWAKAMI (J. Agric. Chem. Soc. Japan, 1939, **15**, 459—472).—The earth in the alkaline district of North Manchuria, from which edible salt or " earth salt " is prepared by extraction with H_2O, filtration, and evaporation, contains approx. 25% of H_2O-sol. material. The latter contains 62—99% of $Na^·$. The amounts of Cl', SO_4'', CO_3'', and HCO_3' vary with external conditions. The deposits near the lake contain more Cl' than SO_4'' and considerable amounts of NO_3' and NO_2'.   J. N. A.

Manganese and gold deposits in the lower and middle Barama River of North-West District, British Guiana. D. A. B. DAVIES (Bull. Imp. Inst., 1939, **37**, 245—251).

History of " Widmanstätten " structure. M. H. HEY (Nature, 1939, **143**, 764).—Widmanstätten's discovery of etch figures on meteoric Fe was anticipated by W. Thomson by several years (Atti Accad. Sci. Siena, 1808, **9**, 37).   L. S. T.

Presence of less common elements in rocks. J. N. FRIEND and J. P. ALLCHIN (Nature, 1939, **143**, 762).—Ni has been detected in dark green inclusions in calcites from Cannington Park, near Bridgwater, and from Weston-super-Mare. The former also contains V. Te has been detected in the insol. residue left after digesting S from Krisuvik, Iceland, with CS_2.   L. S. T.

Tin-bearing deposits of Canali Serci (Villacidro ; Iglesias). P. PIEPOLI and N. COLLARI (Period. Min., 1936, **7**, 147—169 ; Chem. Zentr., 1936, ii, 1510).—The deposits (which are of pneumatolytic-hydrothermal origin) consist chiefly of Zn blende, galena, and pyrites, with marcasite, pyrrhotine, chalcopyrite, tetrahedrite, and cassiterite. The Sn content is $\not>$ a few %.   A. J. E. W.

Transformation of pyroxene-peridotites into rocks containing a predominance of silica and iron in the basin of Lulua and Bushimaie. E. POLINARD (Publ. Congo belge Régions vois., 1936, **59**, 19—33 ; Chem. Zentr., 1936, ii, 1139).—Serpentine is formed by weathering of the Mg minerals, and chalcedony, quartz, opal, oligoclase, and magnetite are produced by removal of all the MgO and part of the FeO, Al_2O_3, and CaO.   A. J. E. W.

Heavy minerals from the older Upper Bavarian molasse. H. ANDRÉE (Jahrb. Min. Beil.-Bd., 1936, **71**, 59—120; Chem. Zentr., 1936, ii, 1139).—A description of the deposits and the associated heavy minerals, consisting predominantly of granite, with zircon, andalusite, tourmaline, etc. The sediments (other than vitreous sands, which are of eruptive origin) are metamorphic. A. J. E. W.

Little-known platinum deposits. F. HERMANN and O. GÜNTHER (Metall u. Erz, 1936, **33**, 349—353; Chem. Zentr., 1936, ii, 4202).—Deposits in Beni Schangul and Wollega (Abyssinia), Sierra Leone, Chile, and Brazil are described. A. J. E. W.

Putten mine, Willenberg. An old gold working at Röversdorf, near Schönau, on the Katzbach (Lower Silesia). A. ZÖLLER (Z. pr. Geol., 1936, **44**, 109—112; Chem. Zentr., 1936, ii, 4202).—Siliceous schist adjoining quartz porphyry contains auriferous pyrrhotite which was extracted by amalgamation; the deposits are now of doubtful val. A. J. E. W.

Copper ore deposits. I. The Hosenberg mining area. H. SCHNEIDERHÖHN and E. KAUTZSCH (Jahrb. Min. Beil.-Bd., 1936, **A**, **71**, 492—523; Chem. Zentr., 1936, ii, 4201).—A geological and petrographical description of the deposits, which are not of workable val. A. J. E. W.

Angularity of granite quartz. F. SCHMITT (Zentr. Min., 1936, **A**, 239—243; Chem. Zentr., 1936, ii, 4201).—The condition of quartz cannot be used in comparing transport processes in sediments, as much primary granite quartz has rounded surfaces. Blasiwald granite quartz has angular and rounded surfaces in the ratio 3 : 7. A. J. E. W.

Chemistry of the weathering process [in alumino-silicate rocks]. R. SCHWARZ (Congr. int. Quim. pura apl., 1934, **9**, III, 320—326; Chem. Zentr., 1936, ii, 4104).—Felspar, anorthite, and leucite are converted into kaolin (I) by several days' treatment with 0·5N-HCl at 320°, under pressure. CO_2 (190 atm.) is ineffective, as the prokaolin–(I) reaction requires acid conditions; H_2SO_4 and HF attack the kaolin. Formation of (I) is subsequent to hydrolysis, and occurs only in presence of a sufficient quantity of dissolved SiO_2; an equilibrium exists between (I) and the Al and SiO_2 in solution. (I) is always deposited from solutions containing sufficient Al and SiO_2, and may thus be formed from various Al silicates in an acid medium at high temp. and pressure. Under other conditions the hydrolysis products give allophantones of variable composition, which are decomposed by HCl. Alkaline media give lateritic deposits owing to the stability of alkaline SiO_2 sols. A. J. E. W.

Electron optical examination of clay minerals. W. EITEL, H. O. MÜLLER, and O. E. RADCZEWSKI (Ber. Deut. Keram. Ges., 1939, **20**, 165—180).— Under magnifications of $15—27 \times 10^3$ the finest fractions of kaolin contain hexagonal laminæ with characteristic sharp edges and cleavage. On heating no change occurs up to 500—600°, when the edges of the laminæ lose their definition, although the faces remain plane and smooth. It is possible that on dehydration the material decomposes, leaving pseudomorphs of SiO_2 and Al_2O_3; at 800—900° these break up into fine particles, from which larger crystals grow again above 1000°. At ~1100—1200° sintering begins. Noll's synthetic kaolin (A., 1937, I, 51) behaved similarly except that the crystals were less uniform, contained traces of raw materials from which they were formed, and the thermal changes occurred at somewhat lower temp. than in the natural product. In pholerite the changes occurred even more readily, perhaps owing to the presence of mineralisers. G. H. C.

Recent methods in mineralogical analysis of clay. W. NOLL (Ber. Deut. Keram. Ges., 1939, **20**, 180—200).—A survey is given of recent advances in analytical technique by the following methods: by sedimentation, optical, ultramicroscopical, and X-ray examination; dehydration, heating and cooling curves; differential solubilities in acid; base-exchange and dye-adsorption methods. G. H. C.

Bentonitic clays from Hawke's Bay.—See B., 1939, 604.

Kroehnkite and natrochalcite from Chile. C. PALACHE (Amer. J. Sci., 1939, **237**, 447—455).— New material from Chuquicamata has permitted a crystallographic re-examination of these minerals (cf. A., 1908, ii, 1047); $a : b : c = 0.4586 : 1 : 0.4357$ and β 108° 30'; ρ is corr. to 2.90 ± 0.02. X-Ray analysis [W. E. RICHMOND] gives $a_0 : b_0 : c_0$ 0·4593 : 1 : 0·4359 with a_0 5·78, b_0 12·58, and c_0 5·48 A.; $v_0 = 378.01$ A.^{3} The formula is $2(CuSO_4,Na_2SO_4,2H_2O)$; space-group C_{2h}^5—$P2_1/C$. Natrochalcite, $Na_2SO_4,Cu_4(OH)_2(SO_4)_3,2H_2O$, has $a : b : c = 1.4239 : 1 : 1.2140$, β 118° 42½', ρ$_{obs.}$ 3·476 and 3.49 ± 0.2, ρ$_{calc.}$ 3·54; CuO 42·01, Na$_2$O 7·98, SO$_3$ 42·42, H$_2$O 7·71% [F. A. GONYER]. X-Ray analysis [W. E. RICHMOND] gives a_0 8·74, b_0 6·15, c_0 6·53 A., β 118° 42½'; space-group C_{2h}^3—$C2/m$. L. S. T.

Occurrence of titanium and nickel in coal.— See B., 1939, 566.

Geology of the area north of Contact Lake, N.W.T., Canada. G. M. FURNIVAL (Amer. J. Sci., 1939, **237**, 476—499).—Mineralogical analyses of meta-argillite, granodiorite, biotite granite, metamorphosed granodiorite, and quartz–enstatite diabase are recorded and discussed. L. S. T.

Isotopes of potassium in phosphate rocks and salts. A. K. BREWER (J. Amer. Chem. Soc., 1939, **61**, 1597—1599).—Using a small modification of the apparatus of Taylor and Urey (A., 1938, I, 526), the base-exchange method of K isotope separation has been studied for 25 soils and phosphate rocks of different origins. In soils in which K has been largely replaced by base exchange $^{39}K : ^{41}K$ should be low and a soil of low K content which acquires K from some abundant source should have a high ratio. The predicted effects have been observed. For most soils the ratio is 14·20 (normal val.) but vals. between 13·90 and 14·20 have been found, indicating deviations in K content. W. R. A.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

SEPTEMBER, 1939.

Coherence of the circular components in the Stark effect. F. SUPPE (Z. Physik, 1939, **113**, 18—27).—From an examination of the influence on the Hg resonance line 2537 A. of electric and magnetic fields, separately and together, it is deduced that the circular components of the Stark effect are coherent.
L. G. G.

Influence of the cathode on the sparking potential of hydrogen. F. L. JONES and J. P. HENDERSON (Phil. Mag., 1939, [vii], **28**, 185—191).—The sparking potential (V) of H_2 has been measured throughout a range of gas pressures of 1—520 mm. Hg, and for electrodes of clean and slightly oxidised Staybrite steel, and pure and commercial Al, Ni, and Cu. The min. val. of V increases with the work function of the cathode surface and it is lowered by impurities in the cathode and by surface oxidation.
C. R. H.

Mechanism of the spark discharge in hydrogen. F. L. JONES (Phil. Mag., 1939, [vii], **28**, 192—202).—Theoretical. The dependence of the sparking potential of H_2 on the cathode material (cf. preceding abstract) can be readily interpreted on the Townsend theory of the spark discharge.
C. R. H.

Sparking potential of deuterium. F. L. JONES (Nature, 1939, **143**, 854).—The effect of a change of cathode material is most pronounced at the min. sparking potential of D_2, which is characteristic of the metal of the cathode after it has been de-gassed. For a given metal the min. sparking potential is sensitive to the state of the cathode surface even after de-gassing. For six cathodes the min. sparking potential of D_2 is 3% > that of H_2.
L. S. T.

Intercombination lines in the spectrum of helium. P. JACQUINOT (Compt. rend., 1939, **208**, 1896—1898).—A no. of intercombination lines occurring as weak satellites of He lines at 4026—5875 A. have been obtained by high-frequency excitation of He at <0·5 mm. pressure. Certain of these lines are attributed to interactions between singlet and triplet systems, and to forbidden interactions.
A. J. E. W.

Atomic energy states of an unusual type. B. EDLÉN and F. TYRÉN (Nature, 1939, **143**, 940—941).—The vac. spark spectra of light elements (B to F) show in the region 60—15 A. groups of lines which do not fit in the ordinary series spectra, but indicate optical energy states high above the ionisation limit, having a character approaching that of X-ray levels.
L. S. T.

Positive column of the nitrogen arc at atmospheric pressure. E. S. LAMAR, A. M. STONE, and K. T. COMPTON (Physical Rev., 1939, [ii], **55**, 1235—1244).—A simplified theory, neglecting convection, for low-current arcs is developed.
N. M. B.

Forbidden transitions in nitrogen. J. KAPLAN (Nature, 1939, **143**, 1066).—The nebular line at 3466·4 A. in at. N has been observed in a high-pressure afterglow in N_2. The weaker nebular line at 5200 A. appeared when panchromatic plates were used. High pressures and small vols. favour the production of forbidden transitions.
L. S. T.

Luminescence of the night sky. J. CABANNES (Compt. rend., 1939, **208**, 1770—1772).—The occurrence of O, first positive N, and Vegard–Kaplan bands in the night sky spectrum is satisfactorily explained by assuming that luminescence is due to O atoms formed by photochemical dissociation of O_2 mols. in daylight (cf. Chapman, A., 1937, I, 208). The energies required for excitation of the bands are considered in detail. The luminescent layer has a temp. of 700—1000° K.
A. J. E. W.

[Spectrum of] the polar aurora. R. BERNARD (Compt. rend., 1939, **208**, 1831—1833; cf. A., 1937, I, 273).—Intensity variations in the N_2^+ and N_2 (2P) band systems in different parts of the aurora are studied and discussed with reference to the origin of the discharge.
A. J. E. W.

D-Lines in the spectrum of the night sky. J. FRANCK and C. A. RIEKE (Astrophys. J., 1939, **89**, 463—464).—A discussion.
L. S. T.

New terms in Fe I, II, and III and additional far ultra-violet standards. L. C. GREEN (Physical Rev., 1939, [ii], **55**, 1209—1217).—The Fe spectrum excited in the Schüler discharge in He and Ne, and the Fe arc and spark in N_2 were investigated in the ultra-violet region λλ 2300—600. New terms are identified and unclassified levels are found in Fe II. Full data and indentifications are tabulated for about 90 lines of Fe I, 450 lines of Fe II, and 45 lines of Fe III. Some lines of accurately calc. λ in the region λλ 2225—1550 are proposed as standards.
N. M. B.

Spectra of palladium, silver, and gold between 90 and 250 A. H. SAUVENIER (Compt. rend., 1939, **208**, 1724—1725).—λλ of lines due to transitions in the M, N, and O levels are recorded; a broadening of the lines due to the Auger effect is observed. Free electron bands occur at 149, 146, and 145 A. (widths 4·5, 5·5, 5·8 e.v.) with Pd, Ag, and Au, respectively; the metals contain 0·55, 1, and 1 electron per atom in the first Brillouin zone. The mean internal potentials of the crystals are 9·5, 9·6, and 10·2 v., respectively.
A. J. E. W.

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Auto-absorption of the continuous spectrum emitted by a xenon tube excited to give white light. M. LAPORTE (Compt. rend., 1939, **209**, 95—98; cf. A., 1938, I, 476).—The absorption coeff. (α) of Xe for its own radiation is deduced from a comparison of the intensities of the emitted light along and perpendicular to the axis of a long cylindrical discharge tube. For red light, $\alpha = 0 \cdot 075$ per cm. at 6 mm. pressure. A. J. E. W.

Auto-absorption of the continuous spectrum of xenon excited to give white light; variation of the auto-absorption coefficient with wavelength. F. GANS (Compt. rend., 1939, **209**, 98—100; cf. preceding abstract).—A microphotometric comparison of spectrograms obtained with the tube in the two positions shows that α varies very slightly at 5000—6500 A., but increases rapidly at shorter $\lambda\lambda$, reaching $0 \cdot 25$ at 4000 A. A. J. E. W.

Isotopic displacement of samarium lines. M. VANJUKOV and S. FRISCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 39—41).—The hyperfine structure of Sm lines, particularly those at 5321 and 5252 A., has been investigated. Both lines consist of four components, the distances between which are given. The anomaly in the isotopic displacements of Sm lines has been confirmed. A. J. M.

Mechanical, magnetic, and quadrupole moments of the rare ^{176}Lu nucleus. H. SCHÜLER and H. GOLLNOW (Z. Physik, 1939, **113**, 1—9; cf. A., 1939, I, 169).—From the fine structure of the Lu II lines $\lambda\lambda$ at 6463 and 5984, the mechanical moment is ≥ 7, the magnetic moment is $\mu = 3 \cdot 8 \pm 0 \cdot 7$ nuclear magnetons, and the quadrupole moment $q = 6$ to 8×10^{-24} cm.^{2} The significance of the abnormally high nuclear mechanical moment in relation to radioactive decay of the ^{176}Lu nucleus is discussed. L. G. G.

Pressure gradient in the positive column. B. KLARFELD and I. POLETAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 460—464).—The axial pressure gradient in a uniform positive column of a Hg discharge has been measured under various conditions. In passing from the cathode to the anode there is an increase in potential gradient and in electron concn., and a decrease in electron temp. At low discharge currents the observed and theoretical vals. of the pressure gradient agree, but they diverge at larger currents. An explanation is advanced. W. R. A.

Gas rarefaction at constrictions in the positive column. B. KLARFELD and I. POLETAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 465—466; cf. preceding abstract).—Rarefaction of the gas at the constriction in the positive column of a Hg discharge at low pressure is indicated by the less intense illumination of the discharge in the constriction, by a decrease in pressure as compared with that on the cathode side, and by the difference in probe current characteristics in the constriction and in the broad cathode section. On increasing the discharge current the walls at the cathode end of the constriction become hot, the illumination from the discharge becomes weak, and, at a crit. current val., the discharge suddenly goes out, due apparently to extreme rarefaction. Extinction of the discharge is facilitated further by the rarefaction occurring at the axis of low-pressure discharge. The phenomena observed by Mohler (A., 1939, I, 112) in Cs vapour can be attributed probably to a lowering of pressure in the constriction in which the measurements were effected. W. R. A.

Varieties of mercury high-pressure column. R. ROMPE and P. SCHULZ (Z. Physik, 1939, **112**, 691—703).—Measurements of arc thickness in the high-pressure Hg discharge are recorded. With arcs consuming power > 500 w. per cm. at pressures >20 atm. the arc thickness is independent of the power. Between 2 and 15 atm. pressure and with 30 to 80 w. per cm. the arc thickness $\propto \sqrt{\text{power}}$. H. C. G.

Red continuous spectrum from the mercury high-pressure discharge. F. RÖSSLER (Z. Physik, 1939, **112**, 667—675).—By means of the known distribution of the intensity of light at 90° to the Hg lamp for lines of known excitation potential it is possible to determine the excitation potentials of the continuous spectrum in the visible and near infra-red. These are all ~ 8 v. The continuous spectra arise from transition between two excited levels, e.g., in the red due to $7^1P_1\Sigma^+ \rightarrow 6^1P_1\Pi$ and in the blue-green to $7^1P_1\Sigma^+ \rightarrow 6^1P_1\Sigma^+$. L. G. G.

Variation with the density of mercury vapour of the intensity of the spectral lines of mercury excited by electron impact. O. S. DUFFENDACK and O. G. KOPPIUS (Physical Rev., 1939, [ii], **55**, 1199—1208).—Using a normal low-voltage arc source, giving approx. ideal conditions, the variation was investigated for Hg alone and for Hg vapour mixed with A or He. Theoretical formulæ which give good agreement with measured vals. are developed, and the bearing of the method on quant. spectrochemical analysis is noted. N. M. B.

Spectra of the true undulatory emission of radon and of its derivatives. Rays attributable to element 85. H. HULUBEI and (MLLE.) Y. CAUCHOIS (Compt. rend., 1939, **209**, 39—42).—Using the crystal spectrograph previously described (cf. A., 1935, 58), the true undulatory emission of Rn has been studied. The spectrum contains the L emissions of elements 82, 83, and 84, of which the rays of 83 predominate. Other rays also observed are probably due to nuclear emissions. The doublets α_1 α_2 and β_1 β_2, and the γ_1 ray of 83, are accompanied by fine and intense satellites. Lines appear corresponding with $L\alpha_1$ and $L\beta_1$ of element 85 which, together with the ray $K\alpha_1$ detected previously (loc. cit.), suggests that element 85 is present among the products of disintegration of Rn. W. R. A.

Spectra of bright chromospheric eruptions from 3300 to 11500 A. R. S. RICHARDSON and R. MINKOWSKI (Astrophys. J., 1939, **89**, 347—355).—Lines showing emission over bright eruptions on the disc are 10830 A. of He, the infra-red triplet of Ca II, the Balmer series from H_a to H_ι, and 3968·494, 3933·684, and 3736·919 of Ca II. In addition to these lines, bright eruptions at the limb showed 10938·12 and 10049·39 A. of H, 6678·149, 5875·79, and 4471·48 of He. No emission was observed at the limit of the Balmer series. L. S. T.

Motion of the spiral nebulæ. A. EAGLE (Nature, 1939, **143**, 856).—The shift of the spectrum lines of the spiral nebulæ towards the red may not be a Doppler effect, but the slowing down of at. vibrations predicted by the Lorentz–Larmor electro-magnetic theory. L. S. T.

Fringe of the atmosphere and the ultra-violet light theory of aurora and magnetic disturbances. S. K. MITRA and A. K. BANERJEE (Indian J. Physics, 1939, **13**, 107—144). T. H. G.

Absorption of monochomatic Röntgen rays in liquid and gaseous carbon disulphide, methylene chloride, and ethyl bromide, and in gaseous methyl iodide between 0·1623 and 1·933 A. H. HANSEN (Ann. Physik, 1939, [v], **35**, 524—546).—Absorption was measured by the filter difference method of Küstner. Mass absorption coeffs. of Cl, Br, I, and S are calc. and agree with previous vals. For Br and I the $C.\lambda^n$ law is obeyed. The absorption by Cl and S is analysed by the method of Küstner and Trübestein (cf. A., 1937, I, 208). O. D. S.

$K\beta$ lines of the oxides of magnesium, aluminium, and silicon, and of silicon carbide; origin of certain satellites. J. FARINEAU (Compt. rend., 1939, **208**, 1725—1727).—The $K\beta_x$ line of the oxides is accompanied by weaker satellites (β' and β_v), but no satellites are observed with the pure metals if air is rigorously excluded. Si in SiC gives a strong β' satellite, the aspect of the line showing a close resemblance to that of C in SiC (A., 1935, 1306). A comparison of the intensities suggests that the spatial distribution of the valency electrons is similar in the oxides and the metals. The β' line is probably associated with the discrete states occurring just below the conductivity levels (cf. Peierls, A., 1932, 896). A. J. E. W.

Optical transparency of selenium in connexion with photo-electric conduction. G. MÖNCH (Physikal. Z., 1939, **40**, 487—488).—The position of the diffuse absorption edge of the transparent modification of Se (Se II) and its variation with temp. have been determined spectrographically. The displacement of the transparency limit of Se II with temp. is approx. the same as the displacement of the photo-electric max. of grey Se (Se III), and the position of the photo-electric max. of the two forms is approx. the same at room temp. It is concluded that the photo-electric properties of Se III are due to included traces of Se II. A. J. M.

Electron transfer in argon. F. L. ARNOT and W. D. HART (Proc. Roy. Soc., 1939, **A, 171**, 383—397).—An investigation of the electron transfer process $A^{++} + A \to A^+ + A^+$ shows that the forward moving A^+ ion has an energy 13 e.v. < that of the incident A^{++} ion. The angle between the directions of motion of the two ions diminishes with increasing energy of the incident ion, and is > that found in the case of Hg. The cross-section for the process has been obtained. Attention is directed to a numerical error in previous work on Hg (cf. A., 1939, I, 230). G. D. P.

Electron scattering and plasma oscillations. H. J. MERRILL and H. W. WEBB (Physical Rev., 1939, [ii], **55**, 1191—1198).—An investigation of the dependence of electron scattering on plasma oscillations for low v.p. and small arc currents in a Hg-arc discharge tube showed the presence of ultimate electrons with a Maxwell–Boltzmann distribution corresponding with ~30,000° K. and a superposed stream of fast electrons from the cathode scattered in narrow planes. The plasma oscillations showed narrow regions of large stable periodic oscillations coinciding generally with the scattering regions. Observed frequencies agreed well with the Tonks–Langmuir formula. The two regions became less marked and moved towards the cathode for increase of v.p. or arc current. Results indicated that scattering is due to plasma oscillations which receive their energy from the fast electrons. N. M. B.

Effects produced by bombarding a metallic surface with fast electrons. J. J. TRILLAT and R. MÉRIGOUX (J. Phys. Radium, 1939, [vii], **10**, 326).—Addendum (cf. A., 1939, I, 394). W. R. A.

Secondary emission of electrons from sodium films contaminated by gas. P. L. COPELAND (Physical Rev., 1939, [ii], **55**, 1270).—The secondary electron emission from thin films of Na on Ta shows rapid variation with energy of bombarding primaries of high energy similar to the variation found by Nelson for primaries of low energy bombarding oxidised films (cf. A., 1939, I, 394), and a similar explanation is discussed. N. M. B.

Electron emission of copper, silver, and aluminium on bombardment with ions of high velocity. E. GRASSMANN (Ann. Physik, 1939, [v], **35**, 465—472).—The electron emission of Cu and Ag, measured with an inhomogeneous ionic beam, varies from 40 to 86% of the no. of bombarding ions for ionic velocities from 7 to 15 kv., and that of Al varies from 300 to 440% for the same velocities. O. D. S.

Measurement of optical life-periods in an atomic jet excited by electron impact. H. BRUCK (Compt. rend., 1939, **208**, 1805—1807).—An at. jet is excited over a narrow region by a focussed transverse beam of electrons, and the path of the luminescent atoms is recorded by a spectrograph. The mean life of atoms in each level is deduced from microphotometer measurements on the corresponding spectrum line, giving the rate of decrease of intensity along the jet (cf. Koenig and Ellett, A., 1932, 439). The method is of general application. Preliminary data for certain levels of Zn, Cd, and Hg (10^{-5}—10^{-7} sec.) are given. A. J. E. W.

Effect in gases submitted to the action of ultra-violet light. G. REBOUL (Compt. rend., 1939, **208**, 2065—2067).—Exposure of gases to ultra-violet light produces large ions of mobility 0.5—0.3×10^{-3} (decreasing with time), which persist for several hr. after irradiation. These ions are of an abnormal type, as they have a pronounced ionising effect for ~30 min. after irradiation has ceased. A. J. E. W.

Stopping power of, and ion formation by, α-rays in gases. K. SCHMIEDER (Ann. Physik, 1939, [v], **35**, 445—464).—The range of, and total ionisation by, Po α-rays have been measured in air, N_2, O_2, NO, NO_2, CO, CO_2, CH_4, C_2H_4, Ne, A, and Kr, and in various mixtures of N_2 and O_2. The ionisations

in O_3 and O_2 are compared. Deviations from the at. additivity rule for stopping power are observed in N_2, NO, NO_2, and N_2O.   O. D. S.

Residual ionisation of gases submitted to the action of X-rays. G. REBOUL and F. PERRIER (Compt. rend., 1939, **208**, 1715—1717; cf. A., 1939, I, 169).—Recombination coeff. and mobility determinations by a special method show that the residual ionisation is due to a mixture of normal and large ions; the latter are not formed by ageing of the normal ions.
                                                                    A. J. E. W.

Residual ionisation of gases submitted to the action of radioactive substances. F. PERRIER (Compt. rend., 1939, **208**, 2064—2065; cf. preceding abstract).—A residual ionisation persisting for several min. after exposure to Ra is due to small ions of mobility $\not< 0.3$ cm. per v. per cm. The recombination coeff. decreases from 6×10^{-6} to 8×10^{-7} in 10 min.   A. J. E. W.

Collision cross-section of K atoms and K_2 molecules in gases. P. ROSENBERG (Physical Rev., 1939, [ii], **55**, 1267; cf. Rosin, A., 1935, 1295).—Measurements, under identical conditions, by a mol. beam method for K and K_2 scattered in H_2, D_2, He, A, and N_2 are reported. The ratio of effective collision cross-section of K_2 to K is ~ 1.2, except for scattering in D_2, for which the val. is 1.36.   N. M. B.

New prospects in isotope separation. H. S. TAYLOR (Nature, 1939, **144**, 8—9).—A review.
                                                                    L. S. T.

Discrepancies in the isotopic weight of ^{12}C. F. W. ASTON (Nature, 1939, **143**, 797—798).—The discrepancies between the author's val. and those of Mattauch (A., 1939, I, 114) and of Jordan and Bainbridge are discussed critically.   L. S. T.

Masses of ^{12}C and ^{14}N. T. ASADA, T. OKUDA, K. OGATA, and S. YOSHIMOTO (Nature, 1939, **143**, 797).—Measurements of the mass differences of $^{12}CH_4 - ^{16}O$ and of $^{12}CH_2 - ^{14}N$ give calc. vals. of 12.00394 ± 0.00018 and 14.00761 ± 0.00021 for ^{12}C and ^{14}N, respectively, using $^1H = 1.00812 \pm 0.00004$.
                                                                    L. S. T.

Isolation of the light isotope of chlorine, at. wt. 34·979, in the separation tube. K. CLUSIUS and G. DICKEL (Naturwiss., 1939, **27**, 487).—^{35}Cl has been isolated (99·6% pure) using the method of thermo-diffusion with a separation tube 20 m. long.
                                                                    A. J. M.

Impulse of recoil by β-decay. L. A. SLIV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 340—342).—Mathematical.   W. R. A.

β- and γ-rays of actinium-B and actinium-C''. B. W. SARGENT (Canad. J. Res., 1939, **17**, A, 82—102; cf. A., 1938, I, 488).—There is evidence that the β-spectrum of Ac-B consists of a strong and a weak primary component, of end-points 1·39 and 0·5 Me.v., respectively, the difference equalling that of a γ-ray emitted in the transformation Ac-$B \rightarrow$ Ac-C. The ratio of no. of β-particles in the two primary spectra is ~ 1.7, which approximates to that obtained from the intensities of the γ-rays.   D. F. R.

Shape of the β-spectrum in the case of the forbidden transitions. V. BERESTECKI (Compt. rend.

Acad. Sci. U.R.S.S., 1939, **23**, 450—454).—Mathematical.   W. R. A.

Lower limit of the continuous β-spectrum of radium-E. A. FLAMMERSFELD (Z. Physik, 1939, **112**, 727—743).—A β-ray spectrograph suitable for work with energies as low as 5 ke.v. is described. By using thin films of radioactive prep. (0·1 μ.) as source, the secondary effects produced by scattering in the thin foil covering the counter-tube aperture, and by re-irradiation from the substrata of the source itself, were measured and found to be comparatively great below 25 ke.v. Measurements free from these secondary effects were made with a Ra-E prep. over the range 25—1170 ke.v. Results do not agree well with the energy distribution curves derived from the theory of β-decomp. by either Fermi or Konopinski and Uhlenbeck.   H. C. G.

γ-Rays of different substances from the active actinium deposit. S. DE BENEDETTI (J. Phys. Radium, 1939, [vii], **10**, 294—295).—The absorption of the γ-radiation of the active deposit of Ac in equilibrium with its derivatives has been studied and Ac-C'' has been isolated. Its radiation consists partly of weak rays (energy $\ll 80$ ke.v.) which are absorbed by 0·5 mm. Pb. The different components of the active deposit are tentatively assigned to relative disintegrations. Most of the hard rays are due probably to the transformation Ac-$B \rightarrow$ Ac-C (830 ke.v.).   W. R. A.

Energy of hard-γ-rays. B. S. DSHELEPOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 24—27). —A new method for measuring the energy of hard γ-rays, involving the use of two counters in a magnetic field, is described. Coincidence of discharges occurs when the electron and positron of one pair enter different counters. The measurement of the no. of coincidences with varying magnetic field gives a linear spectrum. The lines appear only when the energies of the electrons and positrons are $\frac{1}{2}(h\nu - 2m_0c^2)$. The γ-radiation emitted by the excited $^{12}_6C$ nucleus was investigated with the apparatus. The energies obtained agree with those formerly observed, but the intensity ratio is different. The ratio of intensities of the rays of energy 4·2 and 6·7 Me.v. was 14 : 1.
                                                                    A. J. M.

Radiations from radiomanganese. J. V. DUNWORTH (Nature, 1939, **143**, 1065).—Single counter absorption measurements of the β-particles from ^{56}Mn and the results of β–γ and γ–γ coincidence measurements are recorded. The former are consistent with a β-particle spectrum composed of partial spectra, with max. energies of 1·2 and 2·9 Me.v., in the ratio of 0·40 : 0·60. The level scheme obtained for the disintegration of ^{56}Mn from these measurements predicts a γ-ray of 600 ke.v. energy and high intensity. This has been confirmed [A. G. WARD] by using a pressure ionisation chamber.   L. S. T.

Half-periods of actinium-B, actinium-C'', and uranium-X_1. B. W. SARGENT (Canad. J. Res., 1939, **17**, A, 103—105).—The half-periods are recorded as follows : Ac-B, 36.1 ± 0.2 min.; Ac-C'', 4.76 ± 0.02 min.; U-X_1, 24.1 ± 0.2 days.   F. J. G.

Scattering of D group neutrons. M. KIMURA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 153—164).—The back-scattering cross-sections of C and D group neutrons have been measured for a large no. of elements. In many cases differences between the C and D cross-sections were observed. D neutron absorption cross-sections for several elements were estimated from the saturation val. of the back-scattering intensity. D. F. R.

Angular distribution of the fast neutrons scattered by atoms. S. KIKUCHI, H. AOKI, and T. WAKATUKI (Physical Rev., 1939, [ii], **55**, 1264—1265).—The differential cross-sections at different scattering angles determined for Pb and C by using ring scatterers of different sizes show that scattering by C is approx. spherically symmetric, but marked asymmetry is shown by Pb. N. M. B.

Disintegration of nitrogen by fast neutrons. E. BALDINGER and P. HUBER (Nature, 1939, **143**, 894).—Bombardment of N_2 with fast neutrons obtained by the reaction ^2D $(^2D, \, ^1n)$ ^3He gives 1.63×10^{-25} and 0.4×10^{-25} sq. cm. for the cross-sections of the reactions ^{14}N $(^1n, \, ^4\alpha)^{11}B$ and ^{14}N $(^1n, \, ^1H)$ ^{14}C, respectively. The reaction energy for the $^{14}N \to \, ^{11}B$ transformation is -0.43 Me.v. L. S. T.

Short-range α-particles from oxygen, nitrogen, and fluorine bombarded with protons. W. E. BURCHAM and C. L. SMITH (Nature, 1939, **143**, 795—796; cf. A., 1939, I, 397).—A group of α-particles of mean range 0.8 cm. is emitted from a BaF_2 target bombarded with 330-kv. protons (cf. ibid., 54). These particles follow approx. the same resonance curve as that obtained for the γ-rays from proton-bombarded F. At 500 kv. bombarding energy, O_2 emits a group of α-particles of range 2.07 ± 0.05 cm. and N_2 one of 2.57 ± 0.05 cm. range. These groups are assigned to the reactions $^{18}O + \, ^1H \to \, ^{15}N + \, ^4He + 3.96 \pm 0.15$ Me.v. and $^{15}N + \, ^1H \to \, ^{12}C + \, ^4He + 5.00 \pm 0.15$ Me.v., respectively. Vals. obtained for the masses of ^{18}O and ^{12}C are 18.0050 ± 0.0004 and 12.0038 ± 0.0004, respectively. L. S. T.

Excitation function for iron by energetic deuterons. J. M. CORK and B. R. CURTIS (Physical Rev., 1939, [ii], **55**, 1264).—Fe foils after exposure to high-energy deuterons from a cyclotron were examined for activity. The energy–activity curve for the 18-hr. Co formed by a (D, n) reaction shows saturation at 7 Me.v, compared with the expected val. 10—12 Me.v. (cf. Konopinski, A., 1938, I, 430). N. M. B.

Long-lived radioactive ^{55}Fe. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1939, [ii], **55**, 1268—1269; cf. A., 1938, I, 427).—Continued observations over 22 months on the chemically separated Fe fractions from deuteron-bombarded Fe samples show that the 47-day period (^{59}Fe) is accompanied by a much weaker activity of very long half-life attributed to ^{55}Fe formed through ^{54}Fe (D, p) ^{55}Fe with the activity probably leading to stable ^{55}Mn by positron emission or by K-electron capture. N. M. B.

K-electron capture, nuclear isomerism, and the long-period activities of titanium and scandium. H. WALKE, E. J. WILLIAMS, and G. R. EVANS (Proc. Roy. Soc., 1939, A, **171**, 360—382).—

A study was made of the activities induced in Ti and Sc by high-energy deuterons and in Ti by activation with 11-Me.v. α-particles. A radioactive isotope of V has been discovered which decays by K-electron capture, ascribed to ^{47}V. An isomeric form of ^{51}Ti which decays by emitting electrons was detected, tho product nucleus ^{51}V being left in an excited state. The branching decay of ^{46}Sc by K-electron capture and electron emission was observed. The half-life and energy of the disintegrations were measured. G. D. P.

Artificial radioactivity of lead produced by neutrons. H. DE VRIES and G. DIEMER (Physica, 1939, **6**, 599—600; cf. Pool et al., A., 1937, I, 490).—Chemical separations in conjunction with counter measurements show that bombardment of Pb with fast or slow neutrons gives an element of period 80 min. (β-active, half-val. thickness of Al 0.1 mm.), which is probably a Pb isotope produced by a $(n, 2n)$ reaction. A 5 min. period is traced to impurity, probably Zn. A. J. E. W.

Fission of heavy nuclei : a new type of nuclear disintegration. N. FEATHER (Nature, 1939, **143**, 877—879, 1027).—A review of progress. L. S. T.

Emission of neutrons accompanying the fission of uranium nuclei. J. ROTBLAT (Nature, 1939, **143**, 852).—Comparison of the neutron effects of U with those of Cu and Al shows that when bombarded by neutrons from Rn + Be, U gives off more neutrons than either Cu or Al. The apparent excess of neutrons given off by U nuclei probably represents the neutron shower accompanying the fission of an activated U nucleus (cf. A., 1939, I, 233); it is not due to inelastic scattering of neutrons or to the reaction $(n, 2n)$. The calc. no. of neutrons emitted in a single fission is 6. L. S. T.

Energy and range of the heavy uranium residues. O. HAXEL (Z. Physik, 1939, **112**, 681—688).—Bombardment of U with slow neutrons gives rise to two sharply-defined groups of particles the ranges of which $\propto$ their energies. The masses and charges are inversely related to the energies and ranges. L. G. G.

Stability of uranium and thorium for natural fission. W. F. LIBBY (Physical Rev., 1939, [ii], **55**, 1269).—A review of available evidence and experimental data indicates that no fission similar to that induced by neutron absorption can occur naturally for either U or Th. N. M. B.

Further disintegration products of the bombardment of uranium with neutrons. O. HAHN and F. STRASSMANN (Naturwiss., 1939, **27**, 529—534).—Further investigation of the Cs, Rb, Xe, Kr, I, and Br isotopes, which, together with those formerly described, are produced by the bombardment of U with neutrons, has been carried out. Cs isotopes of half-life 6 min. (Cs III) and 33 min. (Cs IV) give rise to Ba of half-life 86 min. (Ba III) and 300 hr. (Ba IV), respectively. Ba II with half-life 14 min. gives rise to an active La isotope. The processes involved are :
$_{92}U + n \to \, _{36}^{88}Kr \to (\beta, \, 3 \text{ hr.}) \, _{37}^{89}Rb \to (\beta, \, 17 \text{ min.})$
$_{38}^{88}Sr + \, _{56}Ba \to (\beta, \, 14 \text{ min.}) \, _{57}La \to (\beta, \, \sim 2.5 \text{ hr.})$
$Ce \, (?); \, _{54}^{139}Xe \to (\beta, \, ?) \, _{55}^{139}Cs \to (\beta, \, 6 \text{ min.}) \, _{56}^{139}Ba \to$
$(\beta, \, 86 \text{ min.}) \, _{57}^{139}La \text{ (stable)}; \, Xe \to (\beta, \, \sim 15 \text{ min.})$

Cs → (β, 33 min.) Ba → (β, 300 hr.) La → (β, 36 hr.) Ce (?). Four active I isotopes are produced from Te by β-change. Te isotopes of half-life 43 min., 66 hr., 1 hr., and 30 hr. give rise to I isotopes of half-life 57 min., 2·3 hr., 18·5 hr., and 8 days, respectively. The breakdown product of the I isotopes is probably Xe. Two weak Br isotopes are also amongst the products of disintegration of U when bombarded with neutrons. Their half-lives are 35 min. and ~230 min.

A. J. M.

Breakdown products from the irradiation of uranium with neutrons. Strontium isotopes. C. LIEBER (Naturwiss., 1939, **27**, 421—423).—The radioactive Sr isotopes produced by breakdown of U when bombarded with neutrons have been investigated. Three Sr isotopes with half-life periods 7 min., 6 hr., and 54 days, respectively, were detected. The second of these gives rise to a Y isotope of half-life 3·5 hr.   A. J. M.

Tracks on photographic plates of the recoil nuclei of disintegration of uranium. L. MYSSOWSKY [MISSOVSKI] and A. JDANOFF [SHDANOV] (Nature, 1939, **143**, 794—795).—Tracks on photographic plates with a thick coat of emulsion of recoil nuclei produced by the action of neutrons on U have a range close to that of the α-particles of U. The no. of recoil nuclei having ranges >1·5 cm. in air is ~100 per sq. cm. per min. (cf. A., 1939, I, 233). Irradiation of Bi, Au, and Pt for hr. with neutrons from a cyclotron produced no recoil nuclei.   L. S. T.

Detection of recoil nuclei in bombardment of uranium with neutrons. A. SHDANOV and L. MISSOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 135—136).—A photographic plate was exposed for 40 min. near a U salt bombarded with slow neutrons. Microscopic examination revealed in addition to γ-ray fog, α-particles, and protons a no. of tracks 2—3 times as dense as those of the α-particles. These tracks, which were not produced by either U or neutrons alone, were attributed to heavy recoil nuclei from U.   J. A. K.

Tracks of recoil nuclei in the disintegration of uranium by neutrons. A. SHDANOV, L. MISSOVSKI, and M. MISSOVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 338—339).—Powdered U metal, when bombarded by neutrons from a cyclotron and photographed using special emulsions, exhibits two characteristic tracks >1·5 cm. in air; one track arises from α-particles and the other, which is thicker and more continuous, from recoil nuclei. It is estimated that a plate of 6 sq. cm. receives ~600 recoil nuclei per min. This estimate agrees with that of Frisch (A., 1939, I, 233) but not with that of Roberts *et al.* (*ibid.*, 234). The energy of recoil nuclei is ~35 Me.v. Similar experiments with Bi, Au, and Pt gave no tracks for recoil nuclei.   W. R. A.

Energy of neutrons liberated in the nuclear fission of uranium induced by thermal neutrons. H. VON HALBAN, jun., F. JOLIOT, and L. KOWARSKI (Nature, 1939, **143**, 939).—Secondary neutrons liberated in U irradiated with thermal neutrons can communicate to O nuclei in an O_2-filled ionisation chamber recoil energies of ~2·5 Me.v. The second-

ary radiation contains, therefore, neutrons possessing an energy of ≮11 Me.v.   L. S. T.

Control of the chain reaction involved in fission of the uranium nucleus. F. ADLER and H. VON HALBAN, jun. (Nature, 1939, **143**, 793).—The energy liberation of the nuclear reaction chain which is possible in the fission of a U nucleus by neutrons is discussed. The addition of a small quantity of an absorbent such as Cd provides the possibility of controlling the energy liberation. The system will become stable at a temp. which is characteristic of the chemical composition and dimensions of the system.   L. S. T.

Decay curves of uranium and thorium fission products. T. BJERGE, K. J. BROSTRØM, and J. KOCH (Nature, 1939, **143**, 794).—Decay curves for the disintegration of U by fast and by slow neutrons and for the disintegration of Th all have the same shape. The curves do not show whether different U isotopes are responsible for the fission produced by slow and by fast neutrons.   L. S. T.

Statistical calculation of composite decay curves. O. R. FRISCH (Nature, 1939, **143**, 852—853).—The radioactive decay curve of the U fission products is compared with a curve calc. on simple statistical assumptions concerning the distribution of decay periods. The agreement indicates that the individual features of the decay curves of Th and U are practically eliminated by the large no. of decay periods (see above).   L. S. T.

Apparent existence of a very penetrating radiation from radium and (radium + beryllium). M. E. NAHMIAS, F. L. HOPWOOD, T. E. BANKS, W. H. RANN, and L. G. GRIMMETT (Nature, 1939, **143**, 1065—1066).—The supposed penetrating radiation from Ra and Ra + Be consisting possibly of mesotrons (A., 1935, 426; A., 1939, I, 174) is shown to be due entirely to γ-rays excited by neutrons in the Pb protection around the Geiger–Müller counter.   L. S. T.

Geiger-counter measurements of the vertical cosmic-ray intensity between sea level and 24,000 ft. W. F. G. SWANN and W. E. DANFORTH (J. Franklin Inst., 1939, **228**, 43—61).—Data were obtained with 10 pairs of Geiger counter telescopes with vertical axis, impulses resulting from the passage of a cosmic ray through one of the telescopes being recorded photographically. A relative vertical intensity curve for observations at sea level and at four altitudes up to 24,000 ft. is given and analysed. A mathematical examination of the comparison of Geiger–Müller with ionisation measurements is developed and discussed in relation to the constituents of the components of cosmic rays.   N. M. B.

Showers in cosmic rays. II. W. HEISENBERG (Z. Physik, 1939, **113**, 61—86; cf. A., 1937, I, 6).—A theoretical examination of the conditions for production of multiple processes in the light of Yukawa's theory.   L. G. G.

Alfvén's hypothesis of a " cosmic cyclotron." E. R. SABATO (Physical Rev., 1939, [ii], **55**, 1272—1273; cf. A., 1937, I, 6, 340).—A criticism.   N. M. B.

The meson and its transformation into heavy particles. R. C. MAJUMDAR and D. S. KOTHARI (Nature, 1939, **143**, 796—797).—When the initial energy of a meson is $> 2 \times 10^9$ e.v. the probability of transformation into a proton and a neutron is high. The protons and neutrons found in cosmic rays may be due to the spontaneous transformation of mesons of very high energies.   L. S. T.

Mesotron and directional distribution of cosmic rays. P. WEISZ (Naturwiss., 1939, **27**, 501).—Assuming that the height at which mesotrons are produced is 0·9 of the height of the homogeneous atm., the decomp. path, L, of the mesotron is ~13 km. at sea-level.   A. J. M.

Search for heavy cosmic-ray particles with a cloud chamber. G. HERZOG (Physical Rev., 1939, [ii], **55**, 1266).—An anticoincidence amplifying set was used to trip the cloud chamber only by those cosmic-ray particles having a further path below a given range and for which mass differences can be detected by ionisation in a cloud chamber. In 118 photographs with a large Wilson chamber, no case showing any observable difference of ionisation from fast electrons was found (cf. Street, A., 1938, I, 9), emphasising the rarity of occurrence of the terminal portion of a mesotron track.   N. M. B.

High-altitude cosmic radiation measurements near the north geomagnetic pole. H. CARMICHAEL and E. G. DYMOND (Proc. Roy. Soc., 1939, **A**, **171**, 321—344; cf. A., 1938, I, 382).—Measurements were carried out in geomagnetic latitude 85° N. by means of a triple coincidence apparatus with radio transmission of the data and a self-recording ionisation apparatus. Comparison of the results with those obtained in lower latitudes shows that no appreciable quantity of low-energy cosmic radiation reaches the earth from outer space, and that there is no incoming radiation in the energy range 3×10^7 to ~10^9 ev. Details of the design of the apparatus are given (cf. following abstract).   G. D. P.

Upper air investigations in North-West Greenland. H. CARMICHAEL and E. G. DYMOND (Proc. Roy. Soc., 1939, **A**, **171**, 345—359).—Observations were made in latitude 76° N. of pressure, temp., and wind speed at heights up to 20 km. A well marked tropopause was found at 11·2 km. and an unusual rise of temp. in the stratosphere; the pilot balloons showed very still air in the stratosphere and a marked velocity max. at 9 km. in the troposphere.   G. D. P.

Cosmic-ray bursts at high altitudes. H. J. J. BRADDICK (Proc. Roy. Soc., 1939, **A**, **171**, 314—321). —Measurements carried out in an aeroplane up to a height of 9·2 km. show that the no. of large bursts increases more rapidly than the no. of small bursts and that both increase more rapidly than the no. of showers recorded by counters. The results suggest a change in the energy distribution of the electrons with height.   G. D. P.

Theory of effects of latitude and asymmetry of cosmic radiation. VI. Cones of cosmic rays infinitely near the equator. VII. Trajectories near the equator. Y. L. TCHANG (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 285—300, 301—345).   F. L. U.

Analysis of the latitude effect of cosmic rays in the stratosphere. S. N. VERNOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 140—142).—A discussion of the distribution, absorption, and composition of cosmic rays in the stratosphere.   J. A. K.

Cosmic rays on the Pacific Ocean. P. S. GILL (Physical Rev., 1939, [ii], **55**, 1151—1159).—A continuation of records previously reported (cf. Compton, A., 1938, I, 9). An atm. temp. coeff. is found to be a function of latitude. There is also a latitude effect, of magnetic origin alone, showing a sharp inflexion at critical N. and S. latitudes, and this inflexion is regarded as associated with the min. energy required for a primary electron to produce mesotrons capable of traversing the atm. The small magnitude of the latitude effect is strong evidence of the secondary nature of mesotrons.   N. M. B.

Study of cosmic rays in the stratosphere in the vicinity of the magnetic equator. S. N. VERNOV and A. V. MIRONOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 137—139).—The altitude distribution of cosmic rays has been studied by recording radio signals automatically transmitted from the impulses of a Geiger counter in a balloon. The energy spectrum of cosmic particles deduced from the results can be interpreted by assuming that in any latitude all particles with energy > the limiting energy for the vertical distance are present.   J. A. K.

Anomalies in the directional intensity distribution of cosmic rays. H. S. RIBNER (Physical Rev., 1939, [ii], **55**, 1271).—An east–west directional intensity survey with apparatus of improved angular resolution confirms the existence of an anomalous directional intensity pattern in the sky, and an analysis of such patterns provides highly refined data on primary rays, their spectra, and their behaviour under absorption.   N. M. B.

Fine structure in the zenith angle distribution of cosmic rays. D. M. COOPER (Physical Rev., 1939, [ii], **55**, 1272; cf. preceding abstract).—Investigations in the eastern azimuthal plane show small deviations of the experimentally observed intensity from the $\cos^2 \theta$ curve as a function of the zenith angle θ.   N. M. B.

Zenith angle distribution of the hard component of cosmic rays and the mass of the mesotron. P. WEISZ (Physical Rev., 1939, [ii], **55**, 1266—1267; cf. A., 1939, I, 236).—Mathematical.   N. M. B.

Variations of cosmic-ray intensity with variations of atmospheric pressure and temperature at sea-level. J. CLAY and E. M. BRUINS (Physica, 1939, **6**, 628—632).—Measurements with an A ionisation chamber under 12 cm. of Fe show a daily variation of intensity (I) during the winter, in approx. parallelism with temp., and an antiparallel variation of I with mean temp. over longer periods. Instruments under 110 cm. of Fe record the latter variation, but not the daily changes. The barometric and temp. coeffs. of I for both sets of instruments are —6·4%

per cm. and −0·21% per °ᴄ.; the high barometric coeff. is probably related to the large vals. obtained with rays at large angles with the vertical.

A. J. E. W.

Decay of penetrating cosmic radiation in different directions. J. CLAY, K. H. J. JONKER, and J. T. WIERSMA (Physica, 1939, 6, 648).—A correction (cf. A., 1939, I, 175). The % of secondary rays in different directions is nearly const., and the particles decay with a mean life-time between 1·7 and 2·0 × 10⁻⁶ sec.

A. J. E. W.

Absorption of hard cosmic rays in different materials. J. CLAY and A. G. M. VAN GEMERT (Physica, 1939, 6, 649—655).—Data are recorded for the absorption of the penetrating rays in H₂O, slate (cf. A., 1939, I, 175), Fe, and Pb for 16° cones at different angles with the vertical. Equiv. absorption occurs in 1, 0·82, and 5·7 m. of Fe, Pb, and H₂O, respectively. The absorption is not ∝ d, and also increases less rapidly than the electron density. The % of secondary rays in different directions is approx. const., but penetrating rays at 60° to the vertical have a high barometric coeff. (∼6% per cm.) and penetrate 30 cm. of Pb with very little absorption.

A. J. E. W.

Ionisation by cosmic rays in gases. J. CLAY and H. J. STAMMER (Physica, 1939, 6, 663—672).—Cosmic-ray ionisation in N₂, A, Kr, and Xe (at ≯50 atm.) has been measured between concentric cylinders, using fields of 50—500 v. per cm. Saturation vals. are calc. by the Jaffé–Zanstra formula, and the wall effects are evaluated. The relative ionisation (I) vals. at 1 atm. under 12 cm. of Fe at sea level are N₂ 1·00, A 1·65, Kr 4·69, Xe ∼7·4. For each gas I = cp or a + bp, according as p is < or > the crit. pressure for the vessel. I increases more rapidly than d for the four gases. Comparison is made with data for γ-ray ionisation.

A. J. E. W.

Expanded shower of cosmic rays in air. H. EULER and H. WERGELAND (Naturwiss., 1939, 27, 484—485).—The formation of expanded showers in cosmic radiation is discussed. The extent of the expansion is independent of the energy of the originating particles and of the no. of particles in the shower. Equations are given which govern the density distribution in the shower. These enable the relative co-incidence frequency of two counter-tubes to be calc. as a function of their distance apart. The calc. frequency is compared with that observed.

A. J. M.

Comparison of cosmic-ray showers underground and at sea level. D. H. FOLLETT (Proc. Physical Soc., 1939, 51, 585—591).—A comparison of counter measurements of cosmic-ray shower frequencies from various thicknesses of Pb at sea level and at a depth of 30 m. in clay indicates that results at sea level accord with the predictions of the cascade theory and that those underground, though less unequivocal, can, after corrections and allowances, be similarly explained without the assumption of any special mechanism.

N. M. B.

Shower of heavy particles. A. SHDANOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 28—30).—Nuclear disintegration effected by cosmic rays in a Wilson cloud chamber has been observed. In an experiment at a height of 9000 m. a disintegration was observed in the form of a heavy particle shower with ∼100 particles. A photograph of the shower is given and discussed.

A. J. M.

Efficiency of electron counters. J. DE VRIES and G. J. SIZOO (Physica, 1939, 6, 593—598; cf. A., 1939, I, 170).—Two counters are arranged so that electrons pass successively through both; the ratio of the no. of coincidences to the no. of counts in the second counter represents the efficiency of the first counter. The efficiency of an air-filled counter (6—10 cm. pressure) for electrons with Hρ vals. of 1000—8400 gauss-cm. is 1 − σᵒⁿ, where n is the mean no. of ions produced per electron, and σ is the probability that a primary ion causes a discharge. Using vals. of n obtained with a Wilson chamber, it is deduced that σ is nearly const. (0·44) for the conditions studied.

A. J. E. W.

Electronic field emission obtained during bombardment of aluminium oxide by electrons or negative ions. A. BOJINESCO (Compt. rend., 1939, 208, 1800—1802).—Bombardment of a surface layer of Al₂O₃ on Al with electrons and negative ions induces strong electronic emission, detected by a positively charged collector, which continues after bombardment has ceased (cf. Malter, A., 1936, 540). With high collector potentials, scintillations appear on the Al₂O₃ surface. The effect is due to the development in the Al₂O₃ layer of a high potential gradient (∼7 Mv. per cm.), which drags the conductivity electrons from the Al support with sufficient velocity to penetrate the surface.

A. J. E. W.

Structure of ¹⁵N. G. BECK (J. Phys. Radium, 1939, [vii], 10, 291—293).—Mathematical. From consideration of known data on the behaviour of ¹⁵N, the order of magnitude of the vals. characteristic of the spectrum of the nuclear levels has been estimated. The data indicate that the distribution of levels is not uniform.

W. R. A.

Limits of application of metric geometry to nuclear physics. I. J. MARIANI (J. Phys. Radium, 1939, [vii], 10, 296—306).—Mathematical.

W. R. A.

Indiscernibility of corpuscles. P. FÉVRIER (J. Phys. Radium, 1939, [vii], 10, 307—323).—Theoretical.

W. R. A.

Ionisation in the troposphere. S. ZIEMECKI (Nature, 1939, 143, 979—980).—Results obtained in three balloon flights indicate that the oscillations of ionisation observed by Suckstorff (Physikal. Z., 1934, 35, 368) in the higher troposphere are due to instrumental errors rather than to radioactive substances of extra-terrestrial origin. The anomalies observed by Juilfs (A., 1939, I, 54) for the lower troposphere are probably due to radioactive substances of terrestrial origin.

L. S. T.

Binding energy of ⁶He and nuclear forces. H. MARGENAU (Physical Rev., 1939, [ii], 55, 1173—1175).—A second-order perturbation calculation of the energy difference ⁶He − ⁶Li, with inclusion of all doubly excited oscillator states, alters the difference only slightly and conserves agreement with experiment (cf.

Feenberg, A., 1937, I, 109), but improves the first-order energy by $\sim 100\%$. Certain conclusions on the detailed nature of the spin forces are discussed.

N. M. B.

Deviation from the Coulomb law for the proton. H. Fröhlich, W. Heitler, and B. Kahn (Proc. Roy. Soc., 1939, A, 171, 269—280).—A mathematical investigation shows that the force between a proton and a negative point charge becomes repulsive at distances $< \frac{1}{8}$ of the electronic radius. The result arises from the fact that the proton spends a certain fraction of its life in a dissociated state as a neutron and a positive mesotron. It is suggested that the calc. deviation explains recent experiments on the fine structure of the D_α and H_α lines of the H spectrum (cf. Williams, A., 1939, I, 1).

G. D. P.

Transmutation function for deuterons. P. L. Kapur (Indian J. Physics, 1939, 13, 87—90; cf. A., 1938, I, 293).—For nuclear reactions involving deuterons of which only the neutron is captured it has been shown mathematically that the concept of the " partial entry " of the deuterons into the coulombic potential barrier of the bombarded nuclei has limited validity. This limit is calc. in terms of the author's previously published theory. Graphs are given showing the way in which the total energy of the outgoing proton varies with that of the bombarding deuteron for a no. of vals. of the potential barrier.

T. H. G.

Polarisabilities and van der Waals forces for atoms in S states. J. K. Knipp (Physical Rev., 1939, [ii], 55, 1244—1254).—Mathematical. Using the Hartree–Fock model, the Møller–Plesset perturbation scheme (cf. A., 1934, 1285) is extended. The approx. vals. found for the at. polarisability of Be and A are $4 \cdot 14 \times 10^{-24}$ and $1 \cdot 28 \times 10^{-24}$ c.c., respectively. The const. μ in the van der Waals energy, $-\mu/R^6$, is $\sim 222 \times 10^{-60}$ for two Be atoms and $63 \cdot 7 \times 10^{-60}$ erg per cm.^{6} for two A atoms. The observed at. polarisability of A is $1 \cdot 63 \times 10^{-24}$ c.c.

N. M. B.

Classical dynamics of the meson. D. Ivanenko (Nature, 1939, 144, 77—78).

L. S. T.

Instability of the mesotron and the gravitational constant. P. M. S. Blackett (Nature, 1939, 144, 30).—If the observed lifetime of a mesotron is to be related to other fundamental consts., g must be included. This has been done, and the result indicates the possibility that the decay of the mesotron provides a link between at. and gravitational phenomena.

L. S. T.

Can technical use be made of the energy of the atomic nucleus ? S. Flügge (Naturwiss., 1939, 27, 402—410).—The energy liberated in nuclear reactions is considered, and the production of a U machine is discussed. It is concluded that an " explosion " in nature is improbable. The applications of the energetics of nuclear reactions to geology are discussed.

A. J. M.

Meson theory of nuclear forces. H. A. Bethe (Physical Rev., 1939, [ii], 55, 1261—1263).—A comparative examination of the assumption that heavy particles can interact (a) only with neutral mesons or (b) with charged as well as neutral mesons, by con-

sideration of spin-dependent and spin-independent forces. Calculations for the ground state of the deuteron favour (a).

N. M. B.

Conservation of momentum in electrical conductivity. W. V. Houston (Physical Rev., 1939, [ii], 55, 1255—1261).—Mathematical.

N. M. B.

Theory of the magnetic moment of the proton. J. Solomon (Compt. rend., 1939, 208, 1795—1797). —The discrepancy in the moment vals. obtained by Rabi (A., 1936, 1316) and Stern (A., 1937, I, 592) is accounted for by considering the virtual emission and absorption of mesotrons by the proton.

A. J. E. W.

Nuclear magnetic moments of ^{14}N, ^{23}Na, ^{39}K, and ^{133}Cs. P. Kusch, S. Millman, and I. I. Rabi (Physical Rev., 1939, [ii], 55, 1176—1181; cf. A., 1939, I, 56).—Vals. measured by the mol. beam magnetic resonance method are $0 \cdot 402$, $2 \cdot 216$, $0 \cdot 391$, and $2 \cdot 572$ nuclear magnetons, respectively. Results agree fairly well, in the case of the alkali nuclei, with the vals. calc. from the observed hyperfine splitting of at. energy states by the Goudsmit–Fermi–Segrè formula. The shape of the resonance curve indicates in some cases a type of interaction of the nucleus with the rest of the mol. which may arise from the nuclear electric quadrupole moment.

N. M. B.

Electric quadrupole moment of the iodine nucleus. T. Schmid (Z. Physik, 1939, 113, 140).— A correction of Murakawa (cf. A., 1939, I, 290).

L. G. G.

Coulomb energies and nuclear models. H. Brown and D. R. Inglis (Physical Rev., 1939, [ii], 55, 1182—1183).—Electrostatic energy differences of isobaric light nuclei, estimated by use of the α-model, do not agree with experiment as well as those given by Bethe (cf. A., 1938, I, 596) for the central model. The comparison with experiment of the binding energies of alphas in the light $4n$-particle in the α-model (cf. Hafstad, A., 1939, I, 6) is improved by inclusion of the Coulomb energy.

N. M. B.

Nuclear isomerism. S. Flügge (Naturwiss., 1939, 27, 470—471).—Theoretical. Weizsäcker's formula for radiation probability leads to a numerical expression for the half-life period of a γ-transition, which is applied to the calculation of the nuclear radii of ^{80}Br, Ma, and ^{104}Rh.

A. J. M.

Contribution of oscillation binding to the nuclear excitation energy. K. Umeda (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, 36, 57—71).—Mathematical.

W. R. A.

Spectral distribution of the light diffused by the photographic image in the ultra-violet. C. Jausseran (Compt. rend., 1939, 209, 37—39).—The spectral distribution of light diffused by a developed photographic image has been studied by photographing the diffused light for different angles of diffusion. For acute angles the λ of the max. intensity increases with the angle; for obtuse angles the proportion of diffused light decreases rapidly towards 3200 a., then remains approx. const. The displacement of the λ of the light as a function of the angle of diffusion can be attributed to the influence of the multiple reflexions of a ray in the course of its passage through the

photographic image. This effect is further complicated by diffraction due to the fineness of the Ag grains.   W. R. A.

Explanation of intensity distribution in the spectrum of aluminium. H. SCHÜLER, H. GOLLNOW, and H. HABER (Naturwiss., 1939, **27**, 420—421). —Evidence against the formation of AlH in the gas space in the thermal excitation of the Al spectrum is given (A., 1939, I, 177; Stenvinkel, *ibid.*, 401). It is considered that the phenomenon is one of mol. formation at the surface of the cathode in the sputtering-vaporisation process. The work of Stenvinkel cannot be directly applied to the present conditions owing to different experimental arrangements.   A. J. M.

Penetration of the potential barrier and formation of AlH. G. STENVINKEL (Nature, 1939, **143**, 854—855).—Enhanced intensities of certain emission lines obtained from Al in H_2 in an electric furnace show that a considerable new formation of AlH mols. takes place in certain states, and demonstrate mol. formation by the H atom penetrating the potential barrier.   L. S. T.

CN and AlO bands in the study of the carbon arc. N. R. TAWDE and S. A. TRIVEDI (Proc. Physical Soc., 1939, **51**, 733—740).—The simultaneous excitation of two band systems in the same source was investigated by measuring the gross intensity distribution in the AlO blue-green and CN violet systems in the C arc, and results are applied to the interpretation of the relation between the vibration temp. and rotation temp. in this source. The ratios of the excitation temp. of the CN system to those of the AlO system measured simultaneously in the same source are compared with available corresponding ratios for C_2 to CH. Results indicate that as long as the mols. remain the same, the ratio of their temp. remains practically const., irrespective of the conditions.   N. M. B.

Completion of term system for carbon monoxide. III. L. GERÖ and R. SCHMID (Z. Physik, 1939, **112**, 676—680; cf. A., 1937, I, 279, 442).— The vibration and rotation levels of the $d^3\pi$ and $a^3\pi$ states which explain the perturbations of the various CO bands are given.   L. G. G.

Spectra of molybdenum chlorides. P. MESNAGE (Compt. rend., 1939, **208**, 1721—1723).—The emission spectrum of a high-frequency discharge in $MoCl_3$ vapour contains arc lines of Mo and diffuse $MoCl_3$ bands with max. at 6400, 6000, 5300, and 4500 A. $MoCl_5$ gives two absorption spectra: *A* (100—200°) has max. at 4650, 3300, and 2800, and a continuum at <2200 A.; *B* (~300°, or at lower temp. with high v.p.) has max. at 4550, 3700, and 2900, and a continuum at <2300 A. The v.d. at 350° corresponds with $MoCl_5$ mols., and the *A*-spectrum is probably due to a polymerised form.   A. J. E. W.

Ultra-violet absorption of solid polymorphic substances. A. BERTON (Compt. rend., 1939, **208**, 1898—1900; cf. A., 1938, I, 433).—The polymorphic form of an org. or inorg. compound which has its absorption limit at the highest λ has also the lowest *d* and thermal stability and the highest solubility and reactivity. This generalisation is illus-

trated by data for anthracene and dianthracene, MeCHO and its polymerides, ZnS, As_2O_3, Sb_2O_3, Bi_2O_3, and TiO_2. Thermal expansion of a solid increases its absorption at higher λλ.   A. J. E. W.

Absorption spectra and optical electrons of tervalent ions of the rare earths. V. DOLEJŠEK and C. ŽADKEVIČ (Coll. Czech. Chem. Comm., 1939, **11**, 196—210).—From a study of aq.-org. solutions of Pr and Nd salts it has been shown that if the dipole moment of the solvent diminishes, the absorption bands of the cations increase and are displaced towards longer λλ, the amount of displacement being of the same order for all the bands. Basing an explanation on Scheibe's theory, it is shown that the optical electrons are in the interior of the ion and are thus protected against external influences, with the result that the chromophores are only slightly deformable.   C. R. H.

Fluorescence of carbonyl compounds in the gas phase. M. S. MATHESON and J. W. ZABOR (J. Chem. Physics, 1939, **7**, 536—538).—The fluorescence spectra of the homologous CO compounds Ac_2, $COMe_2$, COMeEt, MeCHO, $COEt_2$, and EtCHO have been photographed. The fluorescence of the first four compounds consists of three bands at ~5100, 5600, and 6100 A. Fine structure is observed for Ac_2 and MeCHO similar to that reported by Padmanabhan for $COMe_2$ (cf. A., 1937, I, 494). For $COMe_2$ the intensity of the fluorescence becomes weaker with increasing temp. (25—65°). Ac_2 fluorescence also weakens with increasing temp., but < that of $COMe_2$. The data suggest that the fluorescence of these four compounds is due to Ac_2. The fluorescence spectra of $COEt_2$ and EtCHO are similar in all respects with a strong max. at ~5200 A. This fluorescence, by analogy, is probably due to $(COEt)_2$.   W. R. A.

Ultra-violet absorption spectra of 1 : 3-*cyclo*hexadiene. V. HENRI and (Miss) L. W. PICKETT (J. Chem. Physics, 1939, **7**, 439—440).—$\Delta^{1:3}$-*cyclo*-Hexadiene (I) vapour shows an intense absorption band in the region 35,000 to 45,000 cm.$^{-1}$ with 5 max. falling into three groups. In C_6H_{14} solution the band has three max. The vapour of the C_6H_{14} solution of (I) gives bands identical with those of pure vapour of (I). Vals. of oscillator strength have been obtained in good agreement with theoretical predictions using Mulliken's *f* val. Correction of the *f* val. for Lorenz-Lorentz forces in the solution vitiates the agreement.   W. R. A.

Absorption spectrum of thiophen and its homologues. P. BARCHEWITZ and J. GARACH (Compt. rend., 1939, **208**, 2071—2072).—The absorption spectrum (0·6—1 μ.) of thiophen (I) contains two pairs of bands (8665, 8594; 7087, 6995 A.), corresponding with the third and fourth harmonics of the fundamental CH bands; the absence of a band at ~0·97 μ. shows that the mol. contains no ethylenic linking. The shorter-λ component of the CH bands has a lower intensity with 2-methylthiophen, and disappears with 2 : 5-dimethylthiophen; β-substitution has a similar effect on the longer-λ component. The two components are thus due to the α- and β-CH oscillators, which differ owing to the effect of the S atom. Substitution by Me displaces the CH bands to higher λλ.

These bands occur at shorter $\lambda\lambda$ than in C_6H_6 owing to ring strain and the unsaturation of (I). Thionaphthen gives CH bands due to both nuclei. Allyl sulphide gives a more complex spectrum, containing the ethylenic linking band at 0·9704 μ.   A. J. E. W.

Chelate structure of oo'-di[hydr]oxyazobenzene in solution. H. SHINGU (Nature, 1939, **143**, 1068—1069).—The absorption curves for oo'-dihydroxy-azobenzene (I) and o'-anisoleazo-p-cresol in EtOH are practically identical, but in CCl_4 they show differences, indicating that the chelate structure of (I) is somewhat mobile in comparison with that of o-monohydroxyazo-compounds, and that it undergoes with relatively small activation energy a reversible change which is the cause of its enhanced acidity and its marked tendency to form metallic lakes.   L. S. T.

Arrangement of electronic bands in spectra of solutions. II. Absorption of aliphatic nitro-compounds and oximes. G. KORTÜM (Z. physikal. Chem., 1939, B, **43**, 271—291).—An extension of previous work (A., 1939, I, 178) to aliphatic NO_2-compounds and oximes.   W. R. A.

Absorption spectra and structure of compounds containing chains of benzene nuclei. A. E. GILLAM and D. H. HEY (J.C.S., 1939, 1170—1177).—Although chemical tests fail to indicate conjugation of the aryl nuclei in Ph_2 and its derivatives, and so lead to the conclusion that the internuclear link is an invariable single bond uniting two *cyclo*hexatriene rings, dipole moment and X-ray studies suggest that it does possess a measure of double-bond character. Further evidence of internuclear conjugation is provided by an examination of the absorption spectra of di-, p-ter-, p-quater-, p-quinqui-, and p-sexi-phenyl. These show gradual displacement of the principal absorption band towards longer λ as the no. of p-substituted C_6H_6 nuclei increases. However, with m-$C_6H_4Ph_2$ and the series of hydrocarbons containing from 9 to 16 C_6H_6 nuclei linked in the m-positions, all the compounds show the same band (at 2530 A. in $CHCl_3$) but this increases in intensity with the no. of nuclei. It follows, therefore, that in the p-series a measure of conjugation occurs throughout the whole mol., whilst in the m-series, since the structure prevents conjugation extending beyond two C_6H_6 units, the conjugation which gives rise to the absorption spectra is identical with that due to Ph_2 itself. It is shown that the chromophoric unit in both series is half a Ph_2 mol., not a C_6H_6 mol.   T. H. G.

Light absorption of organic compounds and the nature of unsaturated linkages. A. BURAWOY (J.C.S., 1939, 1177—1188).—It is shown that a chromophore is an atom or group which is responsible for the appearance of a certain absorption band in contrast to the various substituents which displace it. Auxochromic groups, the effects of which are described in detail, are the terminal groups of chromophores. The light absorption of org. compounds may be due to either (or, separately, to both) of two different types of chromophoric groups. These are (i) "multiple" linkages E:E' actually existing in the radical state E·E', and the unsaturated atoms of free radicals, such as the C of CPh_3 and (ii) all types of conjugated

systems. It is shown that compounds containing multiple linkages represent equilibria between electron-isomeric mols., i.e., mols. which have the same at. but different electronic structures.   T. H. G.

Spectrographic examination of flavone pigments.—See A., 1939, II, 385.

Absorption spectra of proteins. E. HOLIDAY (Nature, 1939, **143**, 895—896).—A criticism (cf. A., 1939, III, 420).   L. S. T.

Infra-red absorption spectrum of liquid hydrazine. S. S. KRIVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 36—38).—The absorption spectrum of liquid N_2H_4 has been investigated over the range 1—14 μ. The absorption is very strong, intense bands occurring at 11·3, 9·1, 6·2, and about 3·1 μ, the last of which has two max. at 3·06 and 3·13 μ. Weak bands also occur at 7·55, 2·0—2·35 (max. at 2·07, 2·17, 2·28), and 1·57 μ. Comparison with the Raman spectrum shows agreement between a no. of the lines. There is also some approximation to lines in the NH_3 spectrum. The investigation confirms the asymmetry of the N_2H_4 mol.   A. J. M.

Spectrum of hydrogen chloride in the photographic infra-red. E. LINDHOLM (Naturwiss., 1939, **27**, 470).—The 4–0 and 5–0 bands of HCl at 9152 and 7463 A. have been photographed. The ν_0 vals. are 10923·14 and 13396·5 cm.$^{-1}$, respectively. The cubic term in the nuclear vibration formula can be calc. from these vals. The intensity of the bands is small.   A. J. M.

Infra-red absorption spectrum of boron trifluoride. D. M. GAGE and E. F. BARKER (J. Chem. Physics, 1939, **7**, 455—459).—The infra-red absorption spectrum of BF_3 from 400 to 3000 cm.$^{-1}$ consists of 7 bands, which are discussed. Three active fundamentals, each exhibiting an isotope effect, have been observed. One of them, ν_2, is a parallel band which has been partly resolved and yields 79×10^{-40} g. cm.^{2} for the moment of inertia and 1·29 A. for the B—F distance.   W. R. A.

Vibration rotation bands of some polyatomic molecules in the photographic infra-red. H. W. THOMPSON (J. Chem. Physics, 1939, **7**, 441—447).—Infra-red absorption spectra have been measured from 7000 to 12,000 A. for MeSH, NH_2·OMe, MeO·NO, AcOH, Me_2O, MeF, MeCl, MeBr, and MeI and the bands are analysed and discussed. For MeF a moment of inertia of $33·7 \times 10^{-40}$ g. cm.^{2} is deduced from a parallel band.   W. R. A.

Infra-red spectrum of methylamine. H. W. THOMPSON (J. Chem. Physics, 1939, **7**, 448—452).—Using low dispersion the spectrum of NH_2Me has been investigated from 7000 to 12,000 A.; it comprises five bands, of which the most intense is at 10,310 A., and that at 9950 A. has a doublet structure. The 9950 A. band, examined under high dispersion, is of the perpendicular type and yields C—N ~1·47 A., N—H ~1·02 A., angle CNH ~108°. Vibrational assignments have been made. No evidence of internal rotation has been found.   W. R. A.

Transmission of several nitriles in the far infra-red. P. BARCHEWITZ and M. PARODI (Compt.

rend., 1939, **209**, 30—31).—The transmission of PhCN, $CHCl_2 \cdot CN$, EtCN, PrCN, and MeCN has been studied from 180 to 550 cm.$^{-1}$ All the compounds give one absorption band (A) of ν between 369 and 390 cm.$^{-1}$, and another of 244—283 cm.$^{-1}$ That (A) is due to a deformation vibration of the C:N linking is supported by the fact that the corresponding ν, active in the Raman spectra, has been observed for the majority of the compounds. The bands at ν <350 cm.$^{-1}$ observed with MeCN and MeI are attributed to the rotation of the Me group about the axis of symmetry of the mol. (ν = 10·2m, where m is an integer). W. R. A.

Infra-red band of formic acid at 7525 A. H. W. THOMPSON (J. Chem. Physics, 1939, **7**, 453—455).— HCO_2H vapour at 100° gives a weak band at 7525 A. which is the fourth harmonic of the O–H vibration band. Its structure is similar to that of the third harmonic at 9801 A. (A., 1938, I, 60) and is a hybrid band with the perpendicular type component the more intense. From the measured rotational structure the moment of inertia is 10·83 × 10^{-40} g. cm.^{2} W. R. A.

Vibration spectra and molecular structure. VII. Further infra-red studies on the vapours of some carboxylic acids. R. C. HERMANN and R. HOFSTADTER (J. Chem. Physics, 1939, **7**, 460—464).—Spectra of the vapours of $CD_3 \cdot CO_2D$, $CD_3 \cdot CO_2H$, $EtCO_2H$, and $EtCO_2D$ have been investigated from 1 to 16 μ. and bands, assignable to monomeric and dimeric forms, are discussed. The heat of association of $EtCO_2D$ is 14,080±500 g.-cal. per mol. W. R. A.

Infra-red spectrum of ascorbic acid. E. HEINTZ (Compt. rend., 1939, **208**, 1893—1896).— Absorption curves (1—14 μ.) for a solid film and 0·1 and 0·4M-ascorbic acid (I) in a KH_2PO_4–H_3PO_4 buffer (p_H 2·71) are given. The bands are classified into groups due to >C<, C:C, C:O, and OH; bands corresponding with the measured p_K vals. (cf. A., 1935, 444; 1936, 1069) are also observed. 0·1M-(I) gives additional bands at 2·3 and 4·5—4·6 μ., which are ascribed to CO and OH groups. The occurrence of these bands and the oxidation–reduction potential variations in (I) solutions (cf. A., 1938, I, 460; 1939, III, 538) suggest that a free- CO_2H form of (I) is obtained by hydration in dil. solutions (cf. A., 1934, 511). A. J. E. W.

Infra-red absorption spectra of the xylidines and the phenomenon of steric hindrance. Y. TA (Compt. rend., 1939, **208**, 1993—1995).—The absorption spectra of m-2-, m-5-, m-4-, and p-xylidine at 7000—5500 cm.$^{-1}$, containing the first harmonics of the aromatic CH, Me, and NH_2 bands, are studied. The aspect of the CH band differs with each isomeride. With the m-2-compound the NH_2 band is particularly intense, and undergoes a larger displacement towards higher νν on dilution with CCl_4; the aspect of the Me band is also abnormal with this isomeride. The differences are attributed to the effect of steric hindrance on association, which is marked with the m-2-compound. A. J. E. W.

Absorption of some naphthalene derivatives in the very near infra-red. P. BARCHEWITZ

(Compt. rend., 1939, **208**, 1991—1993).—The absorption spectrum of $C_{10}H_8$ (in CCl_4) at 0·6—1 μ. contains the third harmonic of the 3·3 μ. CH band (8775 A.), which has a simple structure. Mono- and di-substitution by Me causes displacement of this band to higher λλ, the Me groups being electropositive with respect to the $C_{10}H_7$ radical; with isomerides the displacement increases with the symmetry of the mol. The Me group gives a triple band with intense components at 9110 and 9210 A. The CH displacements with α- and β-$C_{10}H_7 \cdot NH_2$ and -$C_{10}H_7 \cdot OH$ [which give strong OH bands at 9738 (α) and 9722 A. (β)] are too small to be measured. α-substitution by Cl or NO_2, giving a linking with a negative moment, causes a CH displacement to lower λλ (8765, 8728 A.). A. J. E. W.

Study of cadmium bromide solutions by the Raman effect. Complete Raman spectrum of the cadmitetrabromide [ion]. (MLLE.) M. L. DELWAULLE, F. FRANÇOIS, and J. WIEMANN (Compt. rend., 1939, **208**, 1818—1820; cf. A., 1939, I, 143).— Conc. aq. $CdBr_2$ (with and without added alkali bromide) and solutions of $CdBr_2$ and LiBr in MeOH and octyl alcohol give four Raman lines [53, 62, 181 (depolarised); 166 cm.$^{-1}$ (almost completely polarised)], which are attributed to the tetrahedral $[CdBr_4]''$ ion. Comparison is made with data for $[CdI_4]''$ and analogous Sn ions. A. J. E. W.

Raman spectrum of the trimeric phosphonitrile chloride molecule, $(PNCl_2)_3$. A. M. DE FICQUELMONT, M. MAGAT, and (MLLE.) L. OCHS (Compt. rend., 1939, **208**, 1900—1903).—CCl_4 and CS_2 solutions of $(PNCl_2)_3$ give 15 Raman lines (100— 1230 cm.$^{-1}$), of which four are polarised and four depolarised; the remainder are of low intensity, and probably depolarised. It is deduced that the symmetry of the mol. is D_{3h}, other classes being excluded by the Raman, X-ray, and chemical evidence. A. J. E. W.

Raman spectrum of antimony trimethyl. E. J. ROSENBAUM and T. A. ASHFORD (J. Chem. Physics, 1939, **7**, 554).—The νν of 7 Raman displacements of $SbMe_3$ obtained with an exposure of ~8 hr. and unfiltered Hg radiation are given. W. R. A.

Raman effect of fluorochloromethane. G. GLOCKLER and J. H. BACHMANN (Physical Rev., 1939, [ii], **55**, 1273; cf. A., 1939, I, 300).—Data for 9 Raman shifts at −30° are reported. N. M. B.

Raman effect of difluorodibromomethane and chlorodibromomethane. G. GLOCKLER and G. R. LEADER (J. Chem. Physics, 1939, **7**, 553).—Both compounds show 9 Raman displacements. CF_2Br_2 showed no perceptible photochemical decomp. when exposed cold to $NaNO_2$-filtered Hg radiation. Uncooled $CHClBr_2$ decomposes slightly under unfiltered Hg radiation. W. R. A.

Raman effect. XCIX. Esters of mono- and poly-carboxylic acids. K. W. F. KOHLRAUSCH and R. SABATHY (Monatsh., 1939, **72**, 303—310).— Data are recorded for the Raman spectra of $ClCO_2R$ (R = Pr^β, Bu^a, CH_2Bu^a, CCl_3), $CO(OR)_2$ (R = Pr^a, Pr^β, Bu^a, CH_2Bu^a), $CHBu^\gamma(CO_2Et)_2$,

$(CO_2Et)_2CH \cdot [CH_2]_n \cdot CH(CO_2Et)_2$　$(n = 0, 1, 2, 3)$, Et_2 *cyclo*butane-1 : 1 : 2 : 2-tetracarboxylate, and $Pr^a CO_2 Pr^\beta$. The CO-frequency is lower in the $ClCO_2R$ than in the corresponding $ClCO \cdot CH_2R$, but higher in $CO(OR)_2$ than in $CO(CH_2R)_2$, and in $ROAc$ than in CH_2RAc; between HCO_2R and $HCO \cdot CH_2R$ the difference is negligible. The acid chlorides show additional lines between 500 and 600 cm.$^{-1}$ The effects are attributable to resonance in $ClCO_2R$ giving a partial double bond character to the $C \cdot OR$ linking. L. J. J.

Raman spectra and structure of amides. C. SANNIÉ and V. POREMSKI (Compt. rend., 1939, **208**, 2073—2075).—The Raman spectra of NH_2Ac, $NHAcEt$, $NAcEt_2$, and $NH:CEt_2$ have been studied with the pure compounds and solutions in various solvents. The nature of the solvent has little effect on lines at <1500 cm.$^{-1}$, but pronounced differences occur at 1500—1750 cm.$^{-1}$, indicating the existence of four forms of the amides, for which characteristic Raman ѵѵ are given. A resonance form (cf. A., 1935, 283; 1936, 922) predominates in the pure state and in solution in H_2O and non-polar solvents. Aq. solutions contain an imino-alcohol form, which also occurs to a very small extent in the pure amide, and an association complex (3 mols.). HCl solutions contain an excited form. The true amide form exists only in dioxan solutions of NH_2Ac and in pure $EtCO \cdot NH_2$. The $C:N$ linking occurs in nearly all cases. A. J. E. W.

Raman spectra of some oximes. (MLLE.) D. BIQUARD (Bull. Soc. chim., 1939, [v], **6**, 1230—1233).—Data are recorded for $CMe_2Bu \cdot CPh:N \cdot OH$, $CPhMe:N \cdot OH$, α-$CHPh:N \cdot OH$, $CMePr^a:N \cdot OH$, $CMePr^\beta:N \cdot OH$, and $CEt_2:N \cdot OH$. J. W. S.

Rigidity of liquids. (SIR) C. V. RAMAN and C. S. VENKATESWARAN (Nature, 1939, **143**, 798—799; cf. A., 1939, I, 9).—Spectra of the scattering of the Hg 4046 A. radiation by C_6H_6, AcOH, salol, and glycerol (I) are reproduced. In the spectrum of (I) the rotational wings accompanying the Rayleigh lines are almost absent, indicating that, in respect of light scattering, (I) is practically indistinguishable from an amorphous solid. The behaviour of ultrasonic waves in viscous liquids suggests that for mechanical disturbances of sufficiently high ѵ, a liquid behaves essentially as a solid. L. S. T.

Raman spectrum of benzene in circularly polarised light. J. CABANNES and P. DAURE (Compt. rend., 1939, **208**, 1700—1702).—The depolarisation of a no. of the Raman lines of liquid C_6H_6 is examined by determination of $r = \rho/(1 - \rho)$ with circularly polarised light, enabling small variations of ρ to be detected. A study of polarisation is essential for the classification of higher-order and combination ѵѵ. The 992 cm.$^{-1}$ multiplet is examined, and new components are recorded at 988·4, 990·2, 994·5, 996·2, and 999·6 cm.$^{-1}$ ρ measurements confirm that the 984 and 1005 cm.$^{-1}$ components are due to $^{12}C_5 {}^{13}CH_6$ (A., 1938, I, 175), and that 1585—606 and 1604—606 cm.$^{-1}$ combination ѵѵ occur at 979 and 998 cm.$^{-1}$ (A., 1938, I, 296). A. J. E. W.

Raman spectra of pyrone compounds. M. V. VOLKENSCHTEIN and J. K. SIRKIN (J. Phys. Chem. Russ., 1938, **12**, 677—679).—Dimethylpyrone, its hydrochloride and hydrobromide, coumarin and its hydrochloride, coumarone, and xanthone were investigated. J. J. B.

Distribution of fluorescence excitation of bivalent europium in calcium fluoride and of bivalent samarium in calcium sulphate. H. P. ECKSTEIN (Nature, 1939, **143**, 1067; cf. A., 1938, I, 495).—Photographs showing that prolonged irradiation of Sm (in $CaSO_4$) with short-wave ultra-violet radiations produces an effect similar to that obtained with Ra rays are reproduced. L. S. T.

Fluorescence spectra of the rare earths in synthetic fluorites and their explanation. N. CHATTERJEE (Z. Physik, 1939, **113**, 96—114).—The intensities and $\lambda\lambda$ of the fluorescence spectra, excited by light at 20° and cathode rays at $-180°$, for CaF_2–Sm, CaF_2–Eu, CaF_2–Tb, CaF_2–Dy, CaF_2–Er, and YF_3–Eu are measured and, for comparison, similar data from the absorption spectrum of CaF_2–Eu are given. Results are explained theoretically and J-terms given. L. G. G.

Influence of the size of phosphorescent crystals on the radius of action of α-particles. J. ALLARD and G. DESTRIAU (J. Chim. phys., 1939, **36**, 161—163; cf. A., 1936, 1320).—Analysis of crystals of phosphorescent ZnS containing Cu shows that the Cu content is independent of size. This confirms the view that the increase in the no. of excited contres observed in the smaller crystals is due to an increase in the radius of action of the α-particles. F. L. U.

Sensitisation of phosphorescent zinc sulphide to the action of red rays. J. SADDY (Compt. rend., 1939, **209**, 93—95).—Fe (0·005%) has a sensitising action on the extinction by red light of the phosphorescence of ZnS (Cu 0·007%). The relative extinguishing effect of the red rays rises to a max. much more rapidly in presence of Fe. A. J. E. W.

Position occupied by the activator in impurity-activated phosphors. H. G. JENKINS, A. H. McKEAG, and H. P. ROOKSBY (Nature, 1939, **143**, 978).—X-Ray examination of impurity phosphors shows lattice changes in Zn Be orthosilicate, $CaWO_4$, and Zn_2SiO_4. In Zn_2SiO_4 activated by different % of Mn, the measured lattice expansion is of the kind to be expected from the replacement of Zn atoms by those of Mn, and the activated phosphor can be regarded as a solid solution of Mn_2SiO_4 and Zn_2SiO_4. A solid solution effect is also shown by $CaWO_4$ activated by $\sim3\%$ by wt. of Pb. L. S. T.

Luminescence and photoconductivity of solids. J. T. RANDALL and M. H. F. WILKINS (Nature, 1939, **143**, 978—979).—Measurements on the photoconductivity and phosphorescence decay curves of many luminescent solids afford direct evidence of excitation states in UO_2^{II} salts, in tungstates, and in certain impurity compounds activated by Mn and Cr. UO_2^{II} salts show no photoconductivity, and the exponential phosphorescence decay curves support the view (A., 1939, I, 124) that their luminescence results from the absorption of energy within the co-ordination group

of $UO_2^{..}$. $CaWO_4$, $MgWO_4$, and $ZnWO_4$ show no photoconduction under radiations giving rise to strong fluorescence. Their luminescence is probably similar to that of UO_2^{II}, and arises from transitions between the excitation states and the ground state of WO_4''. Photoconductivity and phosphorescence measurements show that the fluorescence of pure Mn compounds and of solids activated by Mn is frequently due to transitions within $Mn^{..}$ (ibid., 301). Pure $MnCl_2$, and, when activated by Mn, Cd chlorophosphate, borate, and silicate, and Zn mesodisilicate are not photoconducting, and their phosphorescence decay curves are exponential. Pure CaO, and Al_2O_3 with Cr as impurity, are also non-photoconducting. Phosphors that can store luminescent energy at low temp. and release it on warming are photoconducting solids such as willemite and ZnS. Non-photoconducting solids do not show this effect to a marked extent. In the ZnS phosphors it is the long-period phosphorescence that is markedly delayed by cooling. L. S. T.

Luminescence of wetted solids. J. EWLES (Proc. Leeds Phil. Soc., Sci. Sect., 1939, 3, 557—558; cf. A., 1930, 664).—Many wetted white powders (alkali halides, SiO_2, CaF_2, $CaCO_3$, and filter-paper) show appreciable fluorescence when activated by ultra-violet light. The spectra are apparently identical and consist of four broad bands, with max. at 4625, 5200, 5680, and 6100 A. Experiments indicate that the fluorescence is due to H_2O, which may be included inside the crystal grains or adsorbed on internal cracks. D. F. R.

Luminescence of water under the action of ultrasonics. P. PAOUNOFF (Compt. rend., 1939, 209, 33—36).—Under the action of ultrasonics H_2O becomes luminescent only when it contains O_2 or air (experiments with H_2, N_2, and CO_2 were negative). During the luminescence O_2 mols. are converted into O_3. The spectrum of the light contains a wide band from 445 to 558 mμ. which agrees with that of O_3 at the moment of decomp. (460 to 560 mμ.). The intensity of the luminescence increases with the intensity of the ultrasonic excitation. W. R. A.

Luminescence in electric fields and electronic phenomena in semiconductors. G. DESTRIAU (Compt. rend., 1939, 209, 36—37).—An extension of work already noted (cf. A., 1939, I, 301). W. R. A.

Fluorescence and propagation of energy with reversible polymerised dyes. G. SCHEIBE, A. SCHÖNTAG, and F. KATHEDER (Naturwiss., 1939, 27, 499—501).—A summary of work on absorption and fluorescence of dyes of the ψ-isocyanine class, which exist in polymeric forms, is given. The single mols. of such dyes are held together in the polymeric form by van der Waals forces, the hydrophobic hydrocarbon radicals playing an important part in the linking. Each unit in the polymeric mol. can absorb light, since the oscillator strength of the band due to the polymeride is approx. the same as that of the single mol. In consequence of the coupling of the resonators, light energy can be rapidly propagated through mols. It can pass through 10,000 mols. in $<10^{-3}$ sec. Where any interruption occurs the energy

is converted into heat or chemical energy. Such polymeric mols. are able to give up many quanta to foreign mols. in a short time, so that very short-lived intermediate stages could occur in photochemical reactions in which such mols. are concerned. A. J. M.

Ultra-violet chemiluminescence. A. GURWITSCH and L. GURWITSCH (Nature, 1939, 143, 1022—1023).—Experiments showing that the addition of an inert substance, e.g., glucose, to a source of chemiluminescence, e.g., glycine irradiated mitogenetically, introduces new lines into the emission spectrum are described. The new lines are due, presumably, to mols. excited by the energy liberated. L. S. T.

Electronic conduction in crystals. R. HILSCH (Naturwiss., 1939, 27, 489—492).—The conductivity of transparent crystals at temp. at which they are no longer insulators in the dark is considered. The mechanism of the production of the photo-electric secondary current is made clear by considering photo-electric semi-conducting crystals. Rectification by semi-conductors and the scattering of electron currents in crystals are also considered. A. J. M.

Copper–cuprous oxide photo-cells. N. F. MOTT (Proc. Roy. Soc., 1939, A, 171, 281—285).—The behaviour of $Cu–Cu_2O$ photo-cells is interpreted in terms of a theory of the contact between a metal and a semi-conductor (cf. A., 1939, I, 356). G. D. P.

Quantum equivalent of the primary current of the inner photo-effect. F. HLUČKA (Z. Physik, 1939, 113, 56—60).—The spectral yield for diamond, Zn blende, and yellow coloured (X-rays) rock-salt crystals are exemplified in the results for Zn blende in which it is shown that only for a relatively small spectral range at the max. of the current curve is the relation $N = Q/h\nu$ fulfilled (N = no. of electrons released and Q = absorbed energy). L. G. G.

Selenium photo-elements. II. A. BECKER (Z. Physik, 1939, 112, 629—647; cf. A., 1938, I, 4).—A systematic investigation of the properties of Se photo-elements is recorded; special attention is given to their properties in stationary electric fields, to variations of c.d. with incident light, and to the influence of temp. H. C. G.

Photo-electric effect and the photoconductivity of phosphorescent sulphides and fluorides. E. VOYATZAKIS (Compt. rend., 1939, 209, 31—33).—The photo-electric effect of phosphorescent CaS and some fluorides (synthetic and natural) and the photoconductivity of phosphorescent ZnS disappear completely on drying. Phosphorescent ZnS shows only the photoconductivity effect, whilst phosphorescent CaS is photo-electric as well as photo-conductive. W. R. A.

Temperature characteristics of dielectric losses at high frequencies. T. AKAHIRA, M. KAMAZAWA, and Y. TSUMITA (Bull. Inst. Phys. Chem. Res. Japan, 1939, 18, 517—528).—The dielectric loss angle, δ, of various insulating materials has been measured from 20° to 300° and from 10^5 to 10^7 cycles. In general δ increases with temp. and the variation of tan δ is more rapid at low frequencies. No change in

tan δ was observed with quartz, mica, and ambroid. Moisture has a large effect on porcelain and bakelite.
D. F. R.

Electrical conductivity of coloured alkali halides. Z. GYULAI (Z. Physik, 1939, **113**, 28—35). —The sp. conductivity of KCl and KBr coloured crystals $\propto$ voltage, but obedience to Ohm's law is restored by thermal bleaching. Thermally bleached have a lower conductivity than untreated crystals, a phenomenon not observed when the bleaching is done with Br vapour. The variation of conductivity in the coloured crystals is related to the reduced work of release of electrons in electric fields and this is considered in relation to the analogous case of NaCl pastilles containing H_2O vapour.
L. G. G.

Theory of electronic semi-conductors. B. R. A. NIJBOER (Proc. Physical Soc., 1939, **51**, 575—584).— A discussion of the discrepancies between Wilson's theory of semi-conductivity and recent experimental data, and the possibilities of their elimination by an extension of Wilson's theory.
N. M. B.

Measurements on the dielectric constant of carbon dioxide at 25°, 50°, and 100° up to 1700 atmospheres. A. MICHELS and L. KLEEREKOPER (Physica, 1939, **6**, 586—590).—Previous measurements (A., 1933, 447) have been repeated with higher accuracy, and vals. of ϵ, ρ, and the Clausius–Mosotti function are recorded. The last named function has a broad max. at $\rho = \sim300$ Amagat, and a val. of 7·48 c.c. per g.-mol. at 1 Amagat.
A. J. E. W.

Dielectric constant of benzene. W. C. VAUGHAN (Phil. Mag., 1939, [vii], **27**, 661—668).—Using a method described previously (A., 1939, I, 492). Vals. of ϵ for C_6H_6 are : 20°, 2·2818; 25°, 2·2678.
W. R. A.

Molecular freedom and melting in alkyl halides. W. O. BAKER and C. P. SMYTH (J. Amer. Chem. Soc., 1939, **61**, 1695—1701).—Dielectric const. and apparent conductance of liquid and solid $Pr^\beta Br$ and $n\text{-}C_5H_{11}Br$ have been measured at various temp. and frequency and cryst. phases have been examined with the polarising microscope. For $Pr^\beta Br$ hindered rotational freedom is revealed from the f.p. ($-90\cdot8°$) to $\sim -131°$ and the lattice is anisotropic. $n\text{-}C_5H_{11}Br$ gives a monotropic transition at $-88\cdot7°$, $5\cdot9° >$ the f.p., but this does not involve detectable rotational freedom. These and other data yield a correlation of m.p., heats and entropies of fusion, and liquid intervals of alkyl halides with the shapes and mobilities of their mols. in the crystals.
W. R. A.

Dielectric polarisation of solutions of methyl alcohol in 1 : 4-dioxan. Dipole moment of methyl alcohol. J. BENOIT and G. NEY (Compt. rend., 1939, **208**, 1888—1890).—ϵ and d vals. for solutions with MeOH mol. fractions of 0·038—0·272, at 12—50°, are given, and vals. of P_{12} are deduced. The P_{200} vals. for MeOH (82—74) give a dipole moment of $1\cdot84\pm0\cdot01$ D., which is $>$ the vals. obtained for the vapour or C_6H_6 and CCl_4 solutions.
A. J. E. W.

Dipole moments and molecular structure of methyl and ethyl carbonates. G. THOMSON (J.C.S., 1939, 1118—1123).—Measurements in C_6H_6 solution at 25° show that the dipole moments of Me_2CO_3 and Et_2CO_3 are 1·06 and 0·90 D. respectively

as compared with 0·86—1·00 and 1·06 respectively found by Kubo (A., 1937, I, 445 etc.) for the vapours. It is suggested that Kubo's Me_2CO_3 was impure as it forms an azeotropic mixture with MeOH. The moments of the possible planar models (two for Me_2CO_3 and three for Et_2CO_3) have been calc., allowance being made for induction effects. One model for each gives a moment in close agreement with that observed. In each case the structure is that of a fully extended zig-zag symmetrically disposed with respect to the C:O bond. It is shown, by calculation of the induction effect in Et_2O, that the differences in the moments of Me_2CO_3 and Et_2CO_3 are due to this and not to any change in the valency angle of O, which is taken as 111°.
T. H. G.

Polar effects of alkyl groups. J. W. BAKER (J.C.S., 1939, 1150—1155).—Using the results of Baker and Groves (see below) for the dipole moments of PhMe, PhEt, $PhPr^\beta$, and $PhBu^\gamma$, the resultant polar effects of the primary, sec., and tert. alkyl groups are shown to depend jointly on (i) an inductive and inductomeric effect $(+I)$ which increases in the order $Me < Et < Pr^\beta < Bu^\gamma$; (ii) a tautomeric electron-release (see A., 1936, 195) which decreases in the order $Me > Et > Pr^\beta > Bu^\gamma$; (iii) a purely spatial effect increasing in the order $Me < Et < Pr^\beta < Bu^\gamma$. (iii) is operative only when the alkyl is situated right at the seat of the reaction, and (ii) is of minor importance only in the ground state $(+M)$ of the mol. and in reactions which require the recession of electrons from the reaction centre. It may, however, develop dominating importance $(+E)$ in the transition state, in reactions which require electron accession. Adopting the correlation between the electron-release effects of substituents and energy levels which is being proposed by Hughes, Ingold, Masterman, and MacNulty, it is shown that the results of Baker et al. (A., 1936, 195) and of Evans (ibid., 941) on the prototropy of methyleneazomethine systems and of substituted acetophenones can be explained satisfactorily on the basis of the combined polarisation and polarisability effects of the alkyl substituents in the ground and transition states.
T. H. G.

Determination of dipole moments in the vapour phase. II. Moments of alkylbenzenes and alkylcyclohexanes. J. W. BAKER and L. G. GROVES (J.C.S., 1939, 1147—1150).—Using Groves' apparatus (A., 1939, I, 492), the moments of PhMe, PhEt, $PhPr^\beta$, and $PhBu^\gamma$ have been found to be 0·37, 0·58, 0·65, and 0·70 D. respectively. From these results that of $p\text{-}C_6H_4MeBu^\gamma$ (I) should be 0·33 D., in good agreement with the observed val. 0·39 D. As anticipated, the corresponding cyclohexanes have zero moment in the vapour state. The val. for $PhBu^\gamma$ is $\gg$ that obtained by Le Fèvre, Le Fèvre, and Robertson (A., 1935, 684) from observations in solution but the correlation of the present result with those for PhMe and (I) indicates its reliability and that the special explanation suggested by these authors is not necessary.
T. H. G.

Determination of the adiabatic piezo-optic coefficient of liquids. (SIR C.) V. RAMAN and K. S. VENKATARAMAN (Proc. Roy. Soc., 1939, A, **171**, 137—147).—The change of refractive index, n, due to

the sudden application of pressure was measured by an interference method. C_6H_6, CS_2, $CHCl_3$, Et_2O, MeOH, and H_2O were investigated. The results are discussed with reference to (1) the Lorentz refraction formula, (2) the variation of n with temp. at const. density, and (3) the relation between adiabatic and isothermal piezo-optic consts.   G. D. P.

Microscopic examination of gratings with irregularities. H. SIEDENTOPF (Z. Physik, 1939, **112**, 704—726).—The observation of grating-like objects having divisions near the limit of resolution of the microscope is discussed with regard to the mutual interference of diffraction images and the effect produced by slight variations in the lattice spacing.   H. C. G.

Optical activity and chemical structure of tartaric acid.—See A., 1939, II, 357.

Optical activity and magneto-optical activity of crystalline nickel sulphate in the near ultraviolet. F. G. SLACK and P. RUDNICK (Phil. Mag., 1939, [vii], **28**, 241—247).—Optical and magneto-optical data previously obtained have been extended to $\lambda\lambda < 3850$ A., and an improved technique has resulted in some slight adjustment of earlier vals. (cf. A., 1938, I, 563).   C. R. H.

Orientation of a suspended drop of an anisotropic liquid in a magnetic field. V. NAGGIAR (Compt. rend., 1939, **208**, 1916—1918).—Observations on the birefringence rings show that the optic axes in a drop of nematic p-azoxyanisole retained by a hole in a plate are parallel to the free surfaces, and uniformly inclined throughout the drop. A magnetic field parallel to the surfaces produces a parallel inclination of the axes. A magnetic field perpendicular to the drop immediately causes a corresponding orientation of the optic axes within the drop.   A. J. E. W.

Comparison of the quantum-mechanical formulæ derived from magnetic birefringence with experimental results. T. NEUGEBAUER (Z. Physik, 1939, **113**, 115—125).—A comparison of the known Cotton–Mouton consts. for diat. gases with the author's theory (cf. A., 1939, 1, 303).   L. G. G.

Werner complexes. Optical activity and configuration of platinic triethylenediamine ions. J. P. MATHIEU (Bull. Soc. chim., 1939, [v], **6**, 1258—1259).—The mol. rotatory power of [Pt en_3]$Cl_4,3H_2O$ [en = $(CH_2 \cdot NH_2)_2$] obeys the Drude equation over the λ range 6500—4000 A., but shows anomalous dispersion accompanied by circular dichroism at 3400—2700 A. The results, taken in conjunction with the extinction coeff., indicate that the configuration of the Pt complex obeys the same rules as ions of the type [M en_3]$^{\cdots}$ (cf. A., 1936, 410).   J. W. S.

Origins of the atomic theory. J. R. PARTINGTON (Ann. Sci., 1939, **4**, 245—282).

Many-body interactions in atomic and nuclear systems. H. PRIMAKOFF and T. HOLSTEIN (Physical Rev., 1939, [ii], **55**, 1218—1234).—Mathematical.   N. M. B.

General theory of heterophase fluctuations and pretransition phenomena. J. FRENKEL (J. Chem.

Physics, 1939, **7**, 538—547).—Mathematical. An extension of previous work (A., 1939, I, 261) to pre-melting phenomena, "super-transition" states and crystallisation of a supercooled liquid, transitions of higher order, and Curie points.   W. R. A.

Dissociation schemes of the diatomic hydrides and deuterides. E. HULTHÉN (Z. Physik, 1939, **113**, 126—133).—The electron terms of hydrides and deuterides may be classified such that their normal state is derived from the lowest atom combinations. This conflicts with Gerö and Schmid (cf. A., 1939, I, 183), who take no account of the normal state of the metal atom. The theory is supported by results for AlH and AlD.   L. G. G.

Centrifugal distortion of axial molecules. Z. I. SLAWSKY and D. M. DENNISON (J. Chem. Physics, 1939, **7**, 509—521).—Mathematical. The theory of the semi-rigid rotator (A., 1936, 667, 782) has been applied to axial mols. of types YX_3 and ZYX_3. The change in rotational energy due to centrifugal distortion is given in terms of the quantum nos. J and K, the potential consts., and the mol. dimensions. Formulæ are given for NH_3 and ND_3 and comparison of calc. and observed rotation lines of these mols. is satisfactory. PH_3 and Me halides are also discussed.   W. R. A.

Skeletal modes of vibration of long chain molecules. J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 506—509).—Mathematical. The method of Born *et al.* for the determination of the normal modes of vibration of crystals has been applied to determine approx. the skeletal frequencies of C_3H_8, n-C_6H_{14}, and n-C_7H_{16}.   W. R. A.

Molecular oscillators in aromatic molecules. F. LONDON (Compt. rend., 1939, **208**, 2059—2061; cf. A., 1937, 1, 19).—Theoretical. Transitions between Brillouin zones are considered in relation to the circulation of electrons and the production of directional vibrations in aromatic mols. (cf. A., 1938, I, 123).   A. J. E. W.

Dipole–dipole resonance forces. G. W. KING and J. H. VAN VLECK (Physical Rev., 1939, [ii], **51**, 1165—1172).—The r^{-3} variation of polarisation energy of a mol. composed of two identical atoms obeyed at fairly large interat. distances r is examined theoretically. Experimental and calc. data are plotted and discussed for the first excited states of H_2, Na_2, Cd_2, and Hg_2.   N. M. B.

Internal rotation and resonance in hydrocarbons. E. GORIN, J. WALTER, and H. EYRING (J. Amer. Chem. Soc., 1939, **61**, 1876—1886).—Mathematical. Consideration of the restricted rotation about the C·C linking of C_2H_6 indicates that repulsion between H atoms cannot account for the barrier of 3000 g.-cal., nor is the barrier due to distortion of the spherical symmetry around the C atoms by perturbation of the H atoms. Resonance with double-bonded structures, assuming reasonable vals. for the angular dependence of exchange integrals between C orbitals, yields a barrier height of 700 to 1900 g.-cal. When the effect of dissymmetry of C atoms is added to this a barrier of the correct order is obtained. This resonance effect also explains alternation in physical

properties of long-chain compounds. Evidence (X-ray, electron diffraction, Raman effect, infra-red absorption spectra, heat of combustion) concerning the relative stability of staggered and opposed configurations for long-chain and cyclic compounds is reviewed. W. R. A.

Calculation of the shape of protein molecules. A. POLSON (Kolloid-Z., 1939, **88**, 51—61; cf. A., 1936, 879).—The axial ratio b/a and length b of various protein mols., considered as ellipsoids of revolution, have been calc. from the equations of Herzog *et al.* (A., 1934, 357) and Perrin (A., 1937, I, 283). In every case b is the same for the undissociated mol. as for its dissociation product. An empirical modification of Kuhn's equation enables the mol. wts. to be calc. with good approximation from measurements of η, sp. vol., and diffusion const. F. L. U.

Linking energy of the carbon atom. R. SCHMID (Mat. Term. Értesitő Tud. Akad. III. Oszt. Fol., 1936, **54**, 769—793; Chem. Zentr., 1937, ii, 1653).—The free energy changes (ΔA) for a no. of elementary processes are calc. from Parks and Huffman's data and the dissociation energy of CO (159 kg.-cal.). The ΔA vals. can also be calc. to within 1—2% from the following linking energies: C·C 80, C·H 96·5, C·Cl 72·5, C:S 135·6, C:N 180, C·O 75 kg.-cal. The C:O linking energy in aldehydes and ketones is 159, and in CO_2 ~189 kg.-cal. A. J. E. W.

Potential functions of the methyl halides. Z. I. SLAWSKY and D. M. DENNISON (J. Chem. Physics, 1939, **7**, 522—529).—Mathematical. Using a valency form of potential containing five consts., two of which were assumed to be the same for all Me halides, it was possible to predict to 10% the six fundamental $\nu\nu$, and two of the fine structure spacings for Me halides. W. R. A.

Potential function of halogenated derivatives of ethane and ethylene. A. VERLEYSEN (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 267—284).—The potential functions of EtBr have been recalc. and used to evaluate the fundamental frequencies of EtBr, $CH_2D·CH_2Br$, $CHD_2·CD_2Br$, and C_2D_5Br. The vals. so obtained agree fairly with those observed. Similar calculations are made for $CH_2Br·CH_2Br$, CHDBr·CHDBr, $CD_2Br·CD_2Br$, C_2H_3Cl, *cis-* and *trans-*CHCl:CHCl, *cis-* and *trans-*CDCl:CDCl, $CH_2:CCl_2$, and C_2Cl_4. The general inference is drawn that the rigidity of the C·C linking decreases, and the C·X (halogen) valency force and the force opposing deformation of the angle C–C–X increase, with the successive entry of X atoms, and that the last two effects are more pronounced when two X are attached to the same C. F. L. U.

Energy ratio of the OH–OH linking. H. HARMS (Z. physikal. Chem., 1939, B, **43**, 257—270).—The work which must be done against electrostatic dipole attraction in separating two associated dipoles has been calc. for polar and non-polar OH–OH association and for non-polar HBr–HBr, HCl–HCl, and HF–HF association. The results are discussed in relation to solubilities. W. R. A.

Inter-relation of dissociation energy, inter-nuclear distance, and bond order for carbon-carbon linkings. C. H. D. CLARK (Nature, 1939, **143**, 800—801; cf. A., 1938, I, 62).—The heat of dissociation, D, the internuclear distance, r_c, and bond order, x, are connected by the approx. relationships $Dr_e^3 = 282$ and $x^{2/3}r_c^3 = 3.7$. L. S. T.

Correlation between the electronegativity series of organic radicals and bond moments. H. C. BROWN (J. Amer. Chem. Soc., 1939, **61**, 1483—1486).—Bond moments for R–Cl increase thus: R = CPh:C < CHPh:CH < CHMe:CH < CH_2:CH < C_6H_4Me < Ph < Me < Et < Pr^α < Bu^α, n-amyl < Pr^β < *cyclo*hexyl, allyl, CH_2Ph < Bu^γ < $CHPh_2$ < CPh_3. The order of increasing electronegativity (determined by the stability of HgR_2) corresponds, so far as it has been determined, with the order of decreasing bond moment. The same factors are thus responsible for both effects. R. S. C.

Probable length of hydrocarbon chains. (Miss) L. LASKOWSKI and R. E. BURK (J. Chem. Physics, 1939, **7**, 465—469).—Mathematical. The average distance between the centres of the first and last C of a freely rotating hydrocarbon chain is 1·50 times the C—C distance (1·54 A.), which corresponds with a spherical configuration of a thread-like mol. When rotation is restricted by geometric interference the length is a function of the radius of H atoms and vals. in good agreement with experimental data of Mack are obtained. These vals. are approx. those for a freely rotating mol. and are ≪ the extended length. W. R. A.

Magnetism and polymerisation [of dimethyl-butadiene]. J. FARQUHARSON and (MISS) P. ADY (Nature, 1939, **143**, 1067—1068).—Graphs reproduced for the magnetic susceptibility of dimethylbutadiene at the commencement of polymerisation in presence and absence of Bz_2O_2 show that in absence of a catalyst diamagnetism falls for the first 3 hr. and then rises steadily. The fall in diamagnetism may be due to the formation of free radicals, which are paramagnetic, acting as polymerisation nuclei. The concn. of such centres is the same as that of the catalyst necessary to give a smooth curve. L. S. T.

Structure and properties of high mol. wt. organic compounds. V. V. RAZUMOVSKI (J. Gen. Chem. Russ., 1939, **9**, 460—466).—Theoretical. R. T.

Parachor. P. BOGDAN (Compt. rend., 1939, **208**, 2069—2070).—The relation $\gamma V/T^{2/3} = 1$ leads to the expression $[P] = T^{1/4}V^{5/6}$, which gives the "neoparachor," $[P_n]$, derived only from the b.p.; V is evaluated from Kopp's consts. $[P_n]$ and Sugden's additive $[P]$ val. are compared in certain cases, and their use in conjunction is illustrated. The val. of $\gamma V^{2/3}$ at the b.p. (calc. from Sugden's $[P]$) is generally $> T$ for normal and $< T$ for associated compounds. A. J. E. W.

Surface tension and angle of contact of mercury *in vacuo*. A. E. BATE (Phil. Mag., 1939, [vii], **28**, 252—255).—Clean dry Hg in an evacuated tube had an angle of contact (α) 90° and a surface tension of 490 dynes per cm. After admitting air to the tube the Hg

meniscus became convex with $\alpha = 100°$. After two days α had increased to 135°.   C. R. H.

Measurements of the intensity distribution of the white X-radiation reflected from a crystal : dispersion of the atomic scattering factor of zinc near the K absorption edge. J. C. M. BRENTANO, (MISS) J. HONEYBURNE, and J. K. BERRY (Proc. Physical Soc., 1939, 51, 668—682).—The reflexion of the radiation emitted from an X-ray tube by a crystal in an X-ray goniometer gives a pattern of lines on a general background constituted by white radiation from the tube, reflected regularly from the crystal, and by other radiation. A method for the separate assessment of these two background constituents is described, permitting accurate measurement of the intensity-distribution of the reflected white radiation, and is applied to the background discontinuities which form a source of error in the evaluation of reflexion line intensities (cf. A., 1937, I, 552). The method is discussed with reference to the determination of the dispersive change of the at. scattering factor near an absorption edge; by its use f vals. for $\lambda\lambda$ close to the edge can be obtained. Results of experiments on the long-wave side of the Zn K-absorption edge are compared with the wave-mechanical dispersion curve.
                                N. M. B.

Application of a proportional amplifier to X-ray structure analysis. B. ISAEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 42—44).—A proportional amplifier for use in determination of crystal structure by X-ray analysis is described. It will amplify ionisation currents by 10^4, and can therefore be used to examine the structure of substances which will give only a weak diagram, and makes it possible to carry out measurements directly with the use of an electrometer instead of making lengthy photographic exposures. The instrument has been used in the examination of the crystal structure of frog muscle. There are two max. corresponding with identity periods of 10 and 4·5 A. A displacement of the position of the max. occurs as the tissue dries. The method has also been applied to the examination of the structure of Cu and of $NH_2 \cdot CH_2 \cdot CO_2Ag$.   A. J. M.

Homometric structures. A. L. PATTERSON (Nature, 1939, 143, 939—940).—The term " homometric " is used to describe the relation between two structures which possess the same interat. distances, and is restricted to structures giving the same X-ray diffraction pattern. Two point positions each of which leads to two non-identical homometric structures for positive and negative vals. of a single parameter are discussed. The genesis of the homometric property is examined.   L. S. T.

Positions and packing of congruent circles in a plane. U. SINOGOWITZ (Z. Krist., 1939, 100, 461—508).—A rigorous mathematical analysis from the viewpoint of group theory is made and illustrated in 131 diagrams.   I. McA.

Classification of closest and close packings. N. V. BELOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 170—174).—A discussion of the no. of theoretically possible modes of close packing of atoms in crystals.
                                J. A. K.

Atom [form] factors for some heavy ions. G. DASCOLA (Z. Krist., 1939, 100, 537—539).—Theoretical. X-Ray scattering factors, expressed as a function of glancing angle and λ, are calc. by the method of Nagy (A., 1934, 1285; 1935, 679) for the ions Na·, K·, Ca··, Cu·, Mn··, Co···, Co··, Ni··, Cu··, Zn··, As···, Cd··, Sn··, Sb···, Hg··, Pb··, and Bi···. Curves for the first four are compared with other determinations (by Hartree, Fermi, Pauling).
                                I. McA.

Growth of crystals from the vapour phase. J. EHLERS (Schr. min.-petrog. Inst. Univ. Kiel, 1935, 2, 24 pp.; Chem. Zentr., 1937, i, 1639).—Growth of As_2O_3 crystals from the vapour phase occurs only in the octahedral form. The growth faces carry a condensed adsorption layer in which formation and growth of the nuclei occur. The octahedral arrangement of O atoms and other crystallographic details account for exclusive growth on (111) faces, and also for parallel growth, spinel twinning, and skeleton formation. Observations on $HgCl_2$, $HgBr_2$ (which gives a new rhombic form), HgI_2, and mixed crystals are made.
                                A. J. E. W.

Powder patterns on permalloy crystals. J. W. SHIH and T. Y. CHAI (Physical Rev., 1939, [ii], 55, 1265).—The formation of powder patterns on permalloy (Ni 84, Fe 16%), polished with Al_2O_3 powder, indicates that the origin of inhomogeneities of surface magnetisation is not a magnetostriction effect since permalloy has practically no magnetostriction. The mechanical polishing probably produces fragment structure in the surface just below the Beilby layer (cf. Elmore, A., 1937, I, 449).   N. M. B.

Crystal structure of Al_2Ca. H. NOWOTNY and A. MOHRNHEIM (Z. Krist., 1939, 100, 540—542).—The Al_2Ca phase obtained by heating Al with Ca in a sealed quartz tube at 900° has been examined by precision powder X-radiograms. The face-centred cubic cell with a 8·022 A. contains 8 mols.; ρ 2·35. Analysis of indexed estimated intensities favours the space-group O_h and yields for the Al—Al distance 2·83, Ca—Ca 3·47, and Al—Ca 3·32 A. Weak polarisation is inferred.   I. McA.

Crystal structures of rubidium and cæsium [mon]oxides. A. HELMS and W. KLEMM (Z. anorg. Chem., 1939, 242, 33—40).—Rb_2O has the anti-CaF_2 structure, with a 6·74 A. Cs_2O has the anti-$CdCl_2$ structure, with a 6·74 A., α 36·93°.   F. J. G.

Oriented displacement of magnetite by iron. V. A. FRANK-KAMENETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 561—564).—The orientation of the lattice of Fe formed by reduction of Fe_3O_4 parallel with that of the original Fe_3O_4 crystal (cf. A., 1939, I, 304) is explained by the fact that the Fe atoms in the Fe_3O_4 need only to be displaced in the (001) direction to give the lattice of α-Fe; an elementary cell of magnetite gives three layers of at. Fe.
                                L. J. J.

X-Ray study of the crystal structure of silver sulphide. G. GOLL and T. BAKOS (Magyar Chem. Fol., 1936, 42, 110—116; Chem. Zentr., 1937, i, 1640).—A cuprite structure (a 4·89 A.) is confirmed.
                                A. J. E. W.

Crystal structure of synthetic antimony trisulphide. H. P. KLUG and G. B. HEISIG (J. Amer. Chem. Soc., 1939, **61**, 1920—1921).—Red Sb_2S_3, obtained by passing H_2S through an HCl solution of $SbCl_3$ containing tartaric acid, is converted into black Sb_2S_3 at 115°. X-Ray powder photographs reveal that the red variety is amorphous, whilst the black is cryst. and identical with natural stibnite, Sb_2S_3.
W. R. A.

Structure of solid hydrogen fluoride. P. GÜNTHER, K. HOLM, and H. STRUNZ (Z. physikal. Chem., 1939, **B**, **43**, 229—239).—Debye–Scherrer photographs of solid $(HF)_x$ at 91° K. indicate that the crystals are tetragonal or pseudotetragonal, a 5·45, c 9·95 A., with four zig-zag chains of four mols. The distance F—H—F is ~2·7 A. and the angle FH–FH–FH is ~134°.
W. R. A.

Crystal structure of $TiAl_3$, $NbAl_3$, $TaAl_3$, and $ZrAl_3$. G. BRAUER (Z. anorg. Chem., 1939, **242**, 1—22).—A detailed account of work already noted (A., 1939, I, 18).
F. J. G.

Methods of investigating the structure of ice. P. S. VADILO (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 343—344).—Disadvantages of the usual methods of investigating the structure of ice are reviewed. In a new method the ice is exposed in damp air at a few degrees $> 0°$; sublimation ensues and fine crystals, formed over the ice, are oriented according to the orientation of the crystal axes of the specimen selected. Every "sublimed" crystal becomes covered with faces and crystal structure can be determined. In another new method, graph paper or thin textile material is placed on the bottom and side surfaces of a piece of ice and shaded with a soft pencil; the boundaries between separate monocrystals of ice become manifest and lines also appear from which the area of each crystal can be determined.
W. R. A.

Relations between true crystal growth and lattice defects, studied by the crystallisation of sodium nitrate from the melt. R. TIEMEYER (Schr. min.-petrog. Inst. Univ. Kiel, 1935, **1**, 24 pp.; Chem. Zentr., 1937, i, 1639).—$NaNO_3$ single crystals obtained by slow cooling in a temp. gradient from $\not> 60°$ above the m.p. are studied. Growth is most regular near the point of commencement of crystallisation, and in a pointed vessel. The orientation of the single crystal is independent of the direction of the temp. gradient. Defective orientation of the lattice blocks occurs by rotation of the blocks about defined axes, particularly [100], the direction of shortest distance between ions of opposite sign. The nuclear centre is an ordered aggregate of lattice blocks.
A. J. E. W.

Crystallo-optical analysis of strontium aluminates. N. A. TOROPOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 74—75).—Sr aluminates have been prepared synthetically and examined microscopically. $3SrO,Al_2O_3$ crystallises in trapezohedrons of the cubic system. It is optically isotropic, n 1·728±0·003. A compound of the type $5CaO,3Al_2O_3$ has not been found in the $SrO-Al_2O_3$ system. SrO,Al_2O_3 crystallises in prisms. Pseudohexagonal twinning is frequently encountered. It reacts with H_2O. Its birefringence is $\ll$ that of the corresponding Ca compound. $SrO,2Al_2O_3$ forms prismatic crystals optically positive. $SrO,6Al_2O_3$, the analogue of $BaO,6Al_2O_3$, and other aluminates of the β-type form uniaxial, optically negative crystals.
A. J. M.

X-Ray investigation of $LiBi_3O_4Cl_2$ and related substances. L. G. SILLÉN (Z. anorg. Chem., 1939, **242**, 41—46).—By dissolution of Bi_2O_3 or BiOCl in the appropriate fused halide the following *compounds* have been obtained : $LiBi_3O_4Cl_2$ (I), $LiBi_3O_4Br_2$ (II), $LiBi_3O_4I_2$ (III), $NaBi_3O_4Cl_2$ (IV), $NaBi_3O_4Br_2$ (V), $NaBi_3O_4I_2$ (VI), and $Cd_2Bi_2O_4Br_2$ (VII). They are all tetragonal, space-group D_{4h} (4/mmm), and the lattice consts. are : (I) a 3·840, c 12·03 A.; (II) a 3·876, c 12·47 A.; (III) a 3·941, c 13·19 A.; (IV) a 3·877, c 12·13 A.; (V) a 3·925, c 12·55 A.; (VI) a 3·990, c 13·31 A.; (VII) a 3·943, c 12·62 A. At. positions are given.
F. J. G.

Crystal structure and crystallo-chemical properties of heteropoly-compounds. Crystallographic and X-ray investigations on a new group of hydrates of 12-heteropoly-acids. O. KRAUS (Z. Krist., 1939, **100**, 394—413; cf. A., 1937, I, 118, 288).—The $14H_2O$ hydrates of $H_4SiW_{12}O_{40}$, $H_5BW_{12}O_{40}$, $H_4SiMo_{12}O_{40}$, $H_3PW_{12}O_{40}$, and $H_3PMo_{12}O_{40}$ form an isomorphous triclinic series with face-centred cells containing 8 mols.; space-group C_i. Preps. are described, and cell elements, ρ, and typical goniometric data determined. The structural isotypy of the numerous $H_n[XY_{12}O_{40}],nH_2O$ group members which are pseudocubic is discussed in terms of the modes of association of the $[XY_{12}O_{40}]$ anion and hydrated cation units. A comparison with silicates is made. Within cationic tolerance limits, isomorphism extends to related salts (*e.g.*, to the Li, Hg,$15H_2O$, and Th salts for $H_4SiW_{12}O_{40},14H_2O$).
I. McA.

X-Ray determination of the structure of tetramethylammonium dichloriodide crystals, NMe_4ICl_2. R. C. L. MOONEY (Z. Krist., 1939, **100**, 519—529; cf. A., 1938, I, 347).—Structural analysis of the trihalogen ion is favoured by a cation of low scattering power and radius ~ that of $Cs^{.}$. NMe_4ICl_2 is tetragonal, a 9·18, c 5·80 A.; ρ 1·74; 2 mols. per cell; space-group $D_{2d}^3—P\bar{4}2_1m$. Complete at. parameters and inter-distances are determined in accord with visual intensities of oscillation X-radiograms (Mo $K\alpha$). The structure is essentially that of NMe_4I with the larger linear symmetric ICl_2' (I—Cl = 2·34 A.), packed in planes perpendicular to the tetragonal axis, causing a lateral cell extension of 16%.
I. McA.

Crystal structure of glucosamine hydrobromide [and α-chitosamine]. E. G. COX and G. A. JEFFREY (Nature, 1939, **143**, 894—895).—The crystal structures of α-chitosamine hydrochloride and hydrobromide have been determined without reference to stereochemical data. Both are monoclinic sphenoidal, space-group $P2_1$, with 2 mols. per cell, the dimensions of which are a 7·68, 7·96, b 9·18, 9·29, c 7·11, 7·18 A., and β 112° 29′ and 112° 35′, respectively. A diagram showing the structure projected on the (010) plane is reproduced, and at. co-ordinates are tabulated. The analysis shows that (i) for the first time the configur-

ation of a C compound containing several asymmetric centres has been confirmed by direct determination of at. positions and, in particular, that chitosamine is a derivative of glucose and not of mannose (cf. A., 1939, II, 144), (ii) the pyranose ring has a real existence in a cryst. sugar, and (iii) in the α-form of a d-glucose derivative the O on the first and second C are in *cis*-positions.　　　　　　　　　　　　　　　L. S. T.

Electron diffraction investigation of the structure of benzene, pyridine, pyrazine, butadiene-1 : 3, *cyclo*pentadiene, furan, pyrrole, and thiophen. V. SCHOMAKER and L. PAULING (J. Amer. Chem. Soc., 1939, 61, 1769—1780).—From an electron diffraction investigation of C_6H_6 (I), C_5H_5N (II), pyrazine (III), $(CH_2:CH)_2$ (IV), *cyclo*pentadiene (V), furan (VI), pyrrole (VII), and C_4H_4S (VIII) the following interat. distances have been obtained (in A.) : C—H, $1·08\pm0·04$ (I), 1·09 (II), (III), (V), (VI), (VII), (VIII), 1·06 (IV) ; C—C, $1·39\pm0·02$ (I), 1·39 (II), (III), $1·46\pm0·03$ (IV), $1·46\pm0·04$ (V), 1·46 (VI), 1·44 (VII), (VIII) ; C—X (X = S, O, N), $1·37\pm0·03$ (II), $1·35\pm0·02$ (III), 1·53 (V), $1·41\pm0·02$ (VI), $1·42\pm0·02$ (VII), $1·74\pm0·03$ (VIII) ; C=C, $1·35\pm0·02$ (IV), 1·35 (V), (VI), (VII), (VIII). Valency angles are : C–X–C, $101\pm4°$ (V), $107\pm4°$ (VI), $105\pm4°$ (VII), $91\pm4°$ (VIII) ; X–C=C, $109\pm3°$ (V), (VI), $110\pm3°$ (VII), $112\pm3°$ (VIII) ; C=C–C, $124\pm2°$ (IV), $110\pm2°$ (V), $107\pm2°$ (VI), $108\pm2°$ (VII), $113\pm3°$ (VIII). In (II) and (III) the C—N distance is > that expected for Kekulé resonance, presumably due to extra resonance with ionic structures. The degree of resonance stabilisation is in the order (VI) < (VII) < (VIII) as determined by electron diffraction data, electric dipole moment data, resonance energies, chemical information, and simple theoretical considerations. The contribution of excited structures to these mols., other than those characteristic of the conjugated double linkings, are ~10, 24, and 34% respectively. Part of the resonance of (VIII) is with structures with 10 electrons in the valency shell of the S atom.　　　　　W. R. A.

Crystal structure of diphenyldiacetylene. E. H. WIEBENGA (Nature, 1939, 143, 980—981).—Rotation, Weissenberg, and Laue diagrams give a 6·61, b 6·04, c 14·92 A., β 105° ; 2 mols. per unit cell ; $d_{calc.}$ and $d_{obs.}$ are 1·63 ; probable space-group C_{2h}^5 ($P_{21/c}$). The long axes of the mols. form angles of 42°, 38°, and 78° with the a, b, and c axes, respectively. The mols. are flat with straight C chains. The planes of the Ph rings of the two sets of mols. are not parallel with each other or with one of the basal planes. The shortest distance between C of two different mols is 3·45—3·65 A. ; it occurs between C of the Ph.　L. S. T.

Molecular structure of 1 : 2 : 4 : 5-tetrabromo-*cyclo*hexane (m.p. 185°). E. HALMÖY and O. HASSEL (J. Amer. Chem. Soc., 1939, 61, 1601—1602).—1 : 2 : 4 : 5-Tetrabromo*cyclo*hexane is orthorhombic. Bragg photographs give a 7·98, b 7·90, c 7·89 A. ; space-group D_2^3—$P2_12_12$; 2 mols. in unit cell. The dipole moment has been determined. $P_{A+0} = 104·6$, $\mu = 2·2_2$ D. Electron diffraction diagrams of the vapour agree with the model of the mol. based on X-ray observations.　　　　　　　　　　　　　A. J. M.

X-Ray crystal analysis of *trans*-azobenzene. J. J. DE LANGE, J. M. ROBERTSON, and I. WOODWARD (Proc. Roy. Soc., 1939, A, 171, 398—410).—The crystal structure and mol. dimensions of the ordinary or *trans*-form of azobenzene have been determined. Two independent mols. contribute to the unit ; one is flat, but in the other the rings lie in different planes. Vals. of interat. distances are given.　G. D. P.

Structure of aromatic polynitro-compound–hydrocarbon complexes. H. M. POWELL and G. HUSE (Nature, 1939, 144, 77).—The 1 : 1 mol. compound of picryl chloride (I) and C_6Me_6 is orthorhombic with a 14·0, b 9·0, c 15·4 A. ; space-group *Amam* or *Ama*. As no pyro-electric effect is detectable the crystals probably have a symmetry centre. All (I) mols. lie in two sets of planes parallel to (100) separated by a distance of 7 A., whilst those of C_6Me_6 lie in two sets of planes parallel to and half-way between these. There are no valency linkings between (I) and C_6Me_6. Anomalous X-ray diffraction effects show some degree of disorder in the structure, and comparison with the corresponding bromide and iodide shows that the NO_2 mols. are disordered. The structure of the C_6Me_6 layers is identical with that of a single layer in the crystal of (I) itself.　　　　　L. S. T.

Benzil—a skew molecule? C. C. CALDWELL and R. J. W. LE FÈVRE (Nature, 1939, 143, 803).—Data obtained for the dipole moments of benzil (I) and phenanthraquinone in various solvents indicate that (I) has a skew configuration in which the two COPh units lie in planes which are approx. at right angles to each other.　　　　　　　　　　L. S. T.

Structure of benzil. I. E. KNAGGS and K. LONSDALE (Nature, 1939, 143, 1023—1024 ; cf. A., 1927, 612).—X-Ray measurements of cryst. benzil show that the mol. must be of the skew type (see above). The crystals will contain spirals of O atoms somewhat similar to those found in quartz. Simpler mol. structures eliminated by these measurements are discussed.　　　　　　　L. S. T.

Crystallographic investigation of artostenone, the stenone isolated from the Indian summer fruit, *Artocarpus integrifolia*, by means of goniometer and *X*-rays. M. C. NATH and P. L. MUKHERJEE (J. Indian Chem. Soc., 1939, 16, 229—234).—The crystals belong to the monoclinic system ; plate faces a (100) show pronounced elongation along the c axis ; a 17·3, b 10·2, c 7·4 A., β 100° 49′, ρ 1·083, 2 mols. per unit cell, mol. wt. 424·2. The close similarity between the C skeletons of artostenone and ergosterol is pointed out.　　　　　　　W. R. A.

Relation between the lattices of natural and hydrated cellulose. E. SAUTER (Z. physikal. Chem., 1939, B, 43, 294—308 ; cf. A, 1937, I, 604).—A discussion of the data recorded on the lattice structures of natural and hydrated cellulose indicates that the data of Sponsler and Dore (A., 1928, 939) most accurately represent the lattices of the two substances. An explanation of the polymorphism between the two substances is given.　　　　　　　W. R. A.

Macromolecular compounds. Lattice estimation of rubber. E. SAUTER (Z. physikal. Chem., 1939, B, 43, 292—293).—The vals. for the rhombic

cell of cryst. rubber (A., 1937, I, 585) have been confirmed independently by Morss (J. Amer. Chem. Soc., 1938, **60**, 237).   W. R. A.

Structure of insulin. I. LANGMUIR and (MISS) D. WRINCH (Proc. Physical Soc., 1939, **51**, 613—624). —The modified (0001) vector projection for an insulin crystal, examined in relation to the C_2 structure proposed for the insulin mol., confirms the C_2 structure represented by the discron (electron density deviation) system $3s + 3s' - o$ provided it is adequately loaded at its slits. Bernal's suggestion of an 18-discron set structure is shown to be untenable.   N. M. B.

Structure of proteins. I. LANGMUIR (Proc. Physical Soc., 1939, **51**, 592—612).—A lecture.
N. M. B.

Structure of silver films. O. GOCHE and H. WILMAN (Proc. Physical Soc., 1939, **51**, 625—651).— An electron diffraction study of the structure of Ag films condensed in vac. on rock-salt cleavage faces at ~200°, and of the changes produced by heating the films in vac., shows that the reflexion and transmission patterns are in general agreement with Menzer's view of twinned structure of films. General equations are derived for use in considering the geometrical features of rotation patterns yielded by cubic crystals. Heating in vac. at ~500° quickly converts the films into normal relatively perfect single crystals, and such an extensive at. rearrangement is evidence of high mobility of Ag atoms at temp. well below the m.p. not only on the surface but within the lattice.
N. M. B.

Examination of worked metal surfaces by means of electron interference. E. PLESSING (Z. Physik, 1939, **113**, 36—55).—Test pieces of Au, Ni, Ag, Fe, Cu, and Zn polished under C_6H_6, in pure N_2 and in vac., give the same electron diffraction images, themselves identical with those obtained from similar pieces polished in air. The lack of influence of O_2 is also shown by heating polished Ni surfaces in vac. to give a cryst. surface, when the diffraction pattern is that of pure Ni. Polished Zn gives diffraction images which do not correspond with either Zn or ZnO, but rather with a quasi-fluid metal layer. None of the gaseous components of air affects the uppermost layer of metal surfaces during polishing and working.
L. G. G.

Magnets. W. L. BRAGG (Proc. Roy. Inst., 1939, **30**, 783—787).—A lecture.

Freely suspended bodies in electric and magnetic fields. W. BRAUNBEK (Z. Physik, 1939, **112**, 753—763).—It is shown mathematically that a static, stable, free suspension of a system consisting of an electrically non-conducting, rigid body in the electric, magnetic, and gravitational fields of a second system is impossible unless at least one of the systems contains diamagnetic material.   L. G. G.

Free suspension of a diamagnetic body in a magnetic field. W. BRAUNBEK (Z. Physik, 1939, **112**, 764—769).—The construction of a powerful electro-magnet with specially shaped pole shoes is described, the field of which, in air, is capable of the free suspension of Bi (8 mg.) and of arc-lamp C (75 mg.). The method of location of the positions of

stability, at which points the particles may be touched or blown into oscillations of amplitude of 1 cm. without loss of equilibrium, is described.
L. G. G.

Axial magnetic permeability of wires and thin layers of iron at high frequencies. N. A. FLORESCU (Compt. rend., 1939, **208**, 1717—1719; cf. A., 1927, 505; 1932, 448).—Data are recorded for 0·051- and 0·08-mm. Fe wires (λ 80—275 m.) and a partly oxidised Fe layer (80 mμ.) obtained by cathodic sputtering. The decrease of axial permeability at short λλ becomes marked at 200 m.   A. J. E. W.

Can crystals of lower symmetry also be excited piezoelectrically in a simple way? B. PAVLÍK (Z. Krist., 1939, **100**, 414—419).—Mathematical. Consideration of the piezoelectric moduli characterising the hemihedral and hemimorphic classes of monoclinic crystals shows how crystal plates may be cut so that angular distortion is suppressed to give linear oscillations only. Theory is confirmed by dust-figures obtained for sucrose.
I. McA.

Hall effect in an $AuCu_3$ alloy in and out of the orderly condition. A. KOMAR and S. SIDOROV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 143—144).—It has been predicted theoretically that the magnitude of the Hall effect in alloys should change at an order–disorder transition. This has been confirmed experimentally for $AuCu_3$, a three-fold change in the Hall const. being observed.   J. A. K.

Optical properties of very thin layers of potassium. D. HACMAN (Compt. rend., 1939, **208**, 1982—1984; cf. A., 1931, 406; 1932, 1071).—The technique of determining the absorption and reflexion coeffs. (A, B) of 0·57—23-mμ. K films at 2500—5500 A. is described. A is max. between 3600 and 3800 A.; monoat. films (0·57 mμ.) absorb only at 3500—4000 A. The max. becomes broader and is displaced to higher λλ with films >6 mμ. thick. B varies similarly, but its relatively small val. shows that the observed absorption of transmitted light is only to a small extent due to reflexion.   A. J. E. W.

Micellar structure and mechanism of deformation of fibrous substances. VIII. Optical study of Hermans' hydrous cellulose fibres and cellulose acetate films. O. KRATKY and P. PLATZEK (Kolloid-Z., 1939, **88**, 78—88; cf. A., 1939, I, 186).—Calculations based on the net theory agree with the observed double refraction of hydrous cellulose fibres up to an extension of 1·5, beyond which the calc. vals. are too high. An explanation is attempted. The behaviour of cellulose acetate films swollen in aq. dioxan, in contrast with that of cellulose fibres, can be approx. accounted for by assuming micellar flow. Discrepancies are greatest in the least swollen films, in which a condition intermediate between free-floating micelles and a net structure may be assumed.   F. L. U.

Increase in strength of quartz glass through rise of temperature. W. DAWIHL and W. RIX (Z. Physik, 1939, **112**, 654—666).—The breaking strength of quartz glass over the temp. range —60° to 800° and with different forms of heat-treatment

has been measured. The high strength exhibited at 800° cannot be produced at room temp. by any form of heat-treatment, whether followed by chilling or annealing, and is only partly explicable on a basis of healing of faults. It may be explained on the assumption of a type of quartz α–β transition in parts of the glass which still possess a cryst. structure.   L. G. G.

Mechanical after-effect and chemical constitution. J. L. SNOEK (Physica, 1939, **6**, 591—592).—The logarithmic decrement (k) of a pure Fe torsion wire is nearly independent of temp. at —50° to 100°, but if the Fe contains N (~0·02%) k has a sharp max. at 9°, the height of which is ~ ∝ [N]. The height of the max. is reduced by segregation of the N as nitride due to heat-treatment. C gives a less marked but analogous effect at 24°. The phenomenon is related to a magnetic after-effect (cf. A., 1939, I, 186).   A. J. E. W.

Variation of the adiabatic elastic constants of polycrystalline ammonium chloride with temperature for 200—273° K. A. W. LAWSON and R. SCHEIB (Physical Rev., 1939, [ii], **55**, 1268).—Measurements were made by the Balamuth–Rose dynamical method (cf. A., 1935, 276). Curves are given for the variation of the adiabatic Young's and rigidity moduli with temp. through the phase transition at 242·8° K., and for the corresponding variations of the adiabatic compressibility and Poisson's ratio, as calc. from these data. The abs. vals. of the Young's modulus, rigidity modulus, compressibility, and Poisson's ratio at 273·2° K. are $2·733 \times 10^{11}$, $1·096 \times 10^{11}$ dynes per sq. cm., $5·54 \times 10^{-12}$ sq. cm. per dyne, and 0·246, respectively.   N. M. B.

Thixotropy of liquid helium? K. R. DIXIT (Current Sci., 1939, **8**, 254—255).—Comparison of the properties of liquid He with those of a colloid exhibiting thixotropy shows that the transition of He I to He II at the λ point may be thixotropic. This point may be explained in the same way as thixotropy by assuming that during the transition some He mols. become locked in place in their equilibrium positions in a loose-packed structure, whereas the holes may change their places; the position and arrangement of the mols. change during the transition, but the electronic configuration of the mols. remains practically unaltered.   L. S. T.

Co-operative phenomena in transformations in the solid state. J. A. A. KETELAAR (Chem. Weekblad, 1939, **36**, 499—502).—The general mechanism of heteromorphous and homomorphous transformations is outlined, and the case of Ag_2HgI_4 dealt with in some detail.   S. C.

Phase theory and allotropy. F. ZERNIKE (Chem. Weekblad, 1939, **36**, 514—515).—A discussion as to whether many cases included in Smits' complexity theory will not eventually be shown to be due to differences in mol. structure.   S. C.

Study of the allotropes of sulphur by the X-ray diffraction method. II. S. R. DAS and K. GHOSH (Indian J. Physics, 1939, **13**, 91—105).—Two new methods of preparing S_ω are described (cf. A.,

1938, I, 504). One of these involves the cooling of liquid S; the colour of the product depends on the temp. of the liquid S. Insol. S_ω is metastable towards sol. S_α, into which it changes at high temp. at a rate which increases with temp. In the light of certain chemical evidence it is suggested that a layer of SO_2 is present in the insol. varieties of S_α and S_ω; if this is removed from S_ω it becomes sol. The second method of prep., by sublimation, gives a product which is more stable than the above but less so than the S_ω obtained from S_2Cl_2. X-Ray examination shows that the particles of colloidal S are cryst.   T. H. G.

Molecular and cybotactic weight measurements of resinous and crystalline materials. H. L. BENDER (J. Amer. Chem. Soc., 1939, **61**, 1812—1816).—Mol. wts. of $PhOH–CH_2O$ resins and of cryst. abietic acid, determined from the b.p. of their solutions, show wide variation depending on the time and on the initial temp. of preparing the solution. Such mol. wts. are unsuitable for structural determinations and it is suggested that the term cybotactic wt. should be employed to represent the definite but transitory " mol. wt." obtained. Cybotactic wt. will vary with the varying wt. of the solute, particularly in the supercooled state of resins, and with the experimental conditions. The effects of manner of dissolution, solvent, original dissolution temp., time of continued reflux, and of heating and keeping cold on the cybotactic wt. have been investigated.   W. R. A.

Behaviour of amorphous and crystalline quartz in electrostatic field. A. G. VON ALTHEIM (Ann. Physik, 1939, [v], **35**, 417—444).—The polarisation current and true conductivity in direct field of amorphous quartz and of cryst. quartz ∥ and ⊥ to the optic axis have been measured and their temp. variation determined. Cryst. quartz shows no true conductivity ⊥ to the optic axis.   O. D. S.

Magnetism and chemistry. W. KLEMM (Angew. Chem., 1939, **52**, 493—495).—A lecture.

Temperature variation of the magnetic anisotropy of graphite. K. S. KRISHNAN and N. GANGULI (Z. Krist., 1939, **100**, 530—536; cf. A., 1935, 814).—The high susceptibility $\chi_{\parallel}$ along the hexagonal axis is structure-sensitive, *e.g.*, to factors affecting the relation of the basal layers. Measurements now made for $\chi_{\parallel} - \chi_{\perp}$ and $\chi_{\perp}$ in the range —183° to 800° show monotonic decreases of $\chi_{\parallel}$ and $\chi_{\perp}$ with increasing temp.   I. McA.

Magnetic study of the oxides of chromium and manganese. S. S. BHATNAGAR, P. L. KAPUR, and B. PRAKASH (Current Sci., 1939, **8**, 253—254).—The susceptibilities of the oxides have been measured between 293° and 580° K. on a modified form of Gouy's magnetic balance. χ for Cr_2O_3 obtained by the dehydration of Cr hydroxide, the ignition of CrO_3 and of $(NH_4)_2Cr_2O_7$ is $25·6 \pm 0·2 \times 10^{-6}$ at room temp. In each case, the χ–T curve shows a max. at higher temp. The mean val. of μ_B is 3·63 as compared with the theoretical val. of 3·87 for Cr^{III}. For CrO_2,H_2O μ_B is 2·95 compared with the theoretical val. of 2·83 for Cr^{IV}. The measurements also show that MnO_2 and Mn_2O_3 have the structures O:Mn:O and

O(Mn:O)$_2$, respectively, and that for MnO the observed magnetic moment of 5·91 agrees with the calc. val. of 5·92 Bohr magnetons for Mn^{II}.

　　　　　　　　　　　　　　　　　　　L. S. T.

Thermo-magnetic and related properties of metals. T. HIRONE and N. HORI (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 497—508).—Theoretical.

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Supersonic absorption in helium. P. KRAS-NOOSCHKIN and E. PUMPER (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 448—449).—Preliminary measurements of the supersonic absorption in He at frequencies from 586 to 952 kHz. indicate that the recorded data for He and Ne are erroneous. The present measurements support the theory of Stokes and Kirchhoff for the absorption of a sound wave by a monat. gas, as do the previous data for A (A., 1939, I, 189).

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Diphenylmethane as a thermometric standard at 25°. T. DE VRIES and H. A. STROW (J. Amer. Chem. Soc., 1939, **61**, 1796—1798).—Purified CH$_2$Ph$_2$ has m.p. 25·09±0·01°. CH$_2$Ph$_2$ which has been kept in a clear glass bottle in the presence of diffused light shows a marked lowering of the m.p. (24·98° after 4 weeks). After long exposure to light a brown colour develops and the m.p. falls to 24·1°. The m.p. falls to 25·090° from 25·092° in 4 weeks when the substance is stored in a brown bottle.　　　W. R. A.

Atomic heat of iron from 1·1° to 20·4° K. W. H. KEESOM and B. KURRELMEYER (Physica, 1939, **6**, 633—647).—The technique of the measurements in liquid He and H$_2$ is outlined. The results are expressed by $C_v = \gamma T + b T^3$ ($\gamma = 1·20 \times 10^{-3}$; $b = 4·70 \times 10^{-6}$, giving a Debye characteristic temp. of 462° K.), except for a small positive deviation at ~13·5° K., which is ascribed to vaporisation of H$_2$ in cavities in the specimen. The high γ val. is considered in detail, with reference to Stoner's theory.

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Anomalous properties of some anhydrous salts of the iron group at low temperatures. S. SHALYT (Nature, 1939, **143**, 799).—Ni, Co, Fe^{II}, and Cr chlorides show jumps in the sp. heat similar in shape to those exhibited by ferromagnetics. At the temp. of the sp. heat jump FeCl$_2$, CoCl$_2$, and CoI$_2$ exhibit a max. of susceptibility the position and sharpness of which depend on the intensity of the magnetic field. The dependence of susceptibility on the field, the anomaly of the sp. heat, and the temp.-dependence of the susceptibility can be explained by the quenching of the orbits of metallic ions in the electric field of the crystal. At temp. < that of the susceptibility max. the magneto-caloric effect of FeCl$_2$ and CoCl$_2$ is negative, *i.e.*, the salt cools when the magnetic field is applied, and the position and magnitude of the sp. heat jumps depend on the intensity of the magnetic field. These facts support the above hypothesis and cannot be explained by the ordinary transition to the ferromagnetic state.　　　L. S. T

Specific heat of copper sulphate below 1° K. J. ASHMEAD (Nature, 1939, **143**, 853—854).—The sp. heat of CuSO$_4$,K$_2$SO$_4$,6H$_2$O (I) exhibits only a sharp rise due to magnetic interaction at very low temp. CuSO$_4$,5H$_2$O has a relatively large sp. heat

throughout the whole range below 1° K. and the magnetic interaction max. is shifted to a higher temp. In CuSO$_4$,H$_2$O there appears to exist a splitting of the energy levels to give a high sp. heat in the He range. (I) compares favourably with Cs Ti alum as a means of reaching extremely low temp.

　　　　　　　　　　　　　　　　　　　L. S. T.

Anomaly of the specific heat of potassium dihydrogen phosphate at the upper Curie point. W. BANTLE and P. SCHERRER (Nature, 1939, **143**, 980).—A marked anomaly of sp. heat of ~130 g.-cal. per mol. per degree has been observed.　　　L. S. T.

Specific heats of some solid aliphatic acids and their ammonium salts and the atomic heat of nitrogen. S. SATOH and T. SOGABE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 97—105).—The sp. heats of H$_2$C$_2$O$_4$, (CH$_2$·CO$_2$H)$_2$, (OH·CH·CO$_2$H)$_2$ and pyrotartaric acid and their mono- and di-NH$_4$ salts have been investigated. The at. heat of N, deduced from the differences between the mol. heats of the salts and the corresponding acids, is found to be generally ~4·2 as compared with 3·5 deduced from various nitrides (A., 1939, I, 310), but vals. from 1·8 to 6·4 were obtained.　　　W. R. A.

Heat capacity and entropy, heats of fusion and vaporisation, and the vapour pressure of dimethylamine. J. G. ASTON, M. L. EIDINOFF, and W. S. FORSTER (J. Amer. Chem. Soc., 1939, **61**, 1539—1543).—NHMe$_2$, prepared from NO·C$_6$H$_4$·NMe$_2$, has m.p. 180·97° K., b.p. 280·04° K. The v.p., from 201° K. to the b.p., is given by $\log_{10} p$ (mm.) $= -2460·100/T - 8·63900 \log_{10} T + 7·60550 \times 10^{-3}T - 3·51389 \times 10^{-5}T^2 + 5·32410 \times 10^{-8}T^3 + 32·26370$. Using the apparatus described elsewhere (A., 1939, 1, 490) the molal heat capacity has been measured from 14° to 280° K. The heats of fusion and evaporation are, respectively, 1420·1±0·5 and 6330±3 g.-cal. per mol. The molal entropy of the ideal gas at the b.p., 64·28±0·05 entropy units, differs from the val. deduced from data on the mol. spectra by an amount equiv. to the existence of a potential barrier of 3460 g.-cal. hindering the internal rotation of each Me group.　　　W. R. A.

New phenomena in liquid helium. J. D. COCKCROFT (Proc. Roy. Inst., 1939, **30**, 800—813).—A lecture.

Density and compressibility of solid hydrogen and deuterium at 4·2° K. (MISS) H. D. MEGAW (Phil. Mag., 1939, [vii], **28**, 129—147).—An extended account of work previously reported (cf. A., 1936, 1330). d and κ of H$_2$ and D$_2$ are 0·0890±0·0004 and 5·0±0·5×10^{-4}, and 0·2059±0·0010 and 3·3±0·7 × 10^{-4}, respectively (d at 0 kg. per sq. cm. and κ at average of range 0—100 kg. per sq. cm.). C. R. H.

Kinetic theory of gases. I. R. N. PEASE (J. Chem. Educ., 1939, **16**, 242—247).　　　L. S. T.

Elementary theory of condensation. F. CER-NUSCHI and H. EYRING (J. Chem. Physics, 1939, **7**, 547—551).—A new theory of crit. phenomena in liquids is based on the assumption of the presence of holes in a lattice-like structure. The treatment gives a theoretical curve for the ρ of vapour and liquid as a

function of temp. in agreement with the experimental curve.   W. R. A.

Vapour pressure and rate of evaporation of barium oxide. J. P. BLEWETT, H. A. LIEBHAFSKY, and E. F. HENNELLY (J. Chem. Physics, 1939, 7, 478—484).—$BaCO_3$ or $Ba(OH)_2$ was heated slowly in vac. in a Pt crucible covered by a closely fitting Pt lid with a central small hole (diameter 93 mils), until decomp. to BaO was complete, high-frequency induction being used as the source of heat. The temp. was then raised to the evaporating temp. required and maintained there for a definite time (15—60 min.). Oxide vapour escaped through the hole in the lid, was condensed on the inside surface of an inverted Pyrex beaker, and determined as $BaSO_4$. The graph of log m ($m =$ g. per sq. cm. per sec.) against $1/T$ closely resembles that of Claassen and Veenemans (cf. A., 1933, 344). The rate of evaporation was determined also by a second method, which consisted in evaporating BaO from a special Mo furnace crucible (described) through a small hole. Analyses were made as before. The data (1526—1800° K.) agree with that from the first method. The v.p. of BaO is given by $\log_{10} p$ (mm. Hg) $= 8\cdot63 -19{,}400/T$ (1200—1800° K.), and the heat of sublimation is 88,000 g.-cal.   W. R. A.

Influence of pressure on the thermal conductivity of liquid He II. J. F. ALLEN and E. GANZ (Proc. Roy. Soc., 1939, A, 171, 242—250).—The thermal conductivity has been measured in the temp. range 1·2—2·2° K. at pressures up to 25 atm. The pressure coeff. of conductivity is negative above 1·63° K. and positive below that temp. The conductivity of solid He was found to be about 10^{-3} times that of liquid He II. It is concluded that the flow of heat in liquid He II is due to some form of mass transfer other than that due to convection currents set up by density differences in the liquid. An explanation of the change of sign of the pressure coeff. is advanced.   G. D. P.

Superfluidity of liquid helium II. J. FRENKEL (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 21—23).—The explanation of superfluidity (extremely small viscosity) of liquid He II offered by London and Tisza, based on Einstein's theory of the degeneracy of an ideal Bose gas at low temp., is open to the objection that He cannot be regarded as an ideal gas. It should be treated as a substance with a regular arrangement of atoms, but differing from a crystal by a distortion of the layers of atoms. The phenomenon of viscosity is therefore replaced by plastic flow. The superfluidity of He II can be explained on this basis if it is assumed that its elastic limit is zero, and that it is not hardened by the process of plastic slipping.   A. J. M.

Viscosity of gases at high temperatures. G. RIBAUD and V. VASILESCO (Compt. rend., 1939, 208, 1884—1886).—Two flow methods are described for obtaining comparative vals. of η at 0—1600°, using a coiled 0·5-mm. Pt capillary 1 m. long. Vals. of Sutherland's const. for air (113—124), N_2 (110—120), A (142·3—168) (all at 0—1600°), and CO_2 (254—307 at 0—1400°) are deduced.   A. J. E. W.

Relation between fluidity, temperature and chemical constitution of pure liquids. E. C. BINGHAM and S. D. STOOKEY (J. Amer. Chem. Soc., 1939, 61, 1625—1630).—The equation $\phi/T = a + bT + \ldots$ (i) [$\phi =$ fluidity in rhes (reciprocal poise), $T = °$ K.] expresses accurately the fluidity data for a large no. of liquids, and shows deviations only for liquids containing an OH radical. a is const. for all members of a non-associated homologous series; b is an exponential function of the mol. wt. within a given series. These facts allow a second equation, $\phi/T = A_s + \alpha T \cdot 10^{\beta/M - \gamma/M^{1}}$ (ii), to be derived which expresses the fluidity-temp. relations of all the members of a series. The % deviation from (ii) increases gradually with increasing mol. wt. This equation has been successfully applied to data on numerous compounds but shows anomalies, as (i), with OH-compounds. Although the aliphatic acids obey equation (i) fairly well (due probably to the formation of almost stable association complexes), the lines given by $T-\phi/T$ for successive members are randomly placed and show variable slopes. The lines $T-\phi/T$ for alcohols are curved, due to irregular association which varies with temp. The plot of $T-\phi/T$ for H_2O is a straight line from 0° to 25°, and from 25° to 100°, curving slightly at 25°.   W. R. A.

Viscosity function. II. Viscosity and constitution. E. P. IRANY (J. Amer. Chem. Soc., 1939, 61, 1734—1739).—In certain liquids "association" is postulated and the question of whether η should be correlated to the strength of intermol. binding forces or to the vol. change due to "association" is considered. Association factors are fractional nos. because of the presence of several mol. species and equilibria between these species should be sensitive to temp. variation. The association factors as deduced from empirical rules of constitutionally additive η are not real; most liquids are not associated and the rules thus amended are wrong. Intermol. forces must be included in the concept of constitution and the presence of different mol. species in an "associated" liquid will be revealed by the deviation from linearity of curves drawn on the graphical method of functional scales (A., 1938, I, 610). From consideration of the equation of the liquid state it is concluded that no rule of constitutive η can be generally valid unless it postulates two independent parameters and thus supposedly additive at. consts. of η can not be specified. In high-polymeric homologous series one parameter is const. and the other is constitutionally additive. Various series show behaviour in agreement with this view.   W. R. A.

Dependence on temperature of the viscosity of melts. E. JENCKEL (Z. physikal. Chem., 1939, 184, 309—319).—Theoretical. Two η-T formulæ have been derived and the simpler of them is successfully applied to η data.   C. R. H.

Effect of laminar and turbulent flow on the X-ray diagram of water and nitrobenzene. Contribution of X-rays to the problem of turbulent flow. W. DUBS (Helv. Phys. Acta, 1939, 12, 169—228).—The flow of liquids in tubes has been investigated by a visual and an X-ray method, with

particular regard to the transition from laminar to turbulent flow. X-Ray diagrams of H_2O and $PhNO_2$ showed little difference for the two states of flow. A. J. M.

Viscosity of ideal mixtures. G. P. LUTSCHINSKI (J. Phys. Chem. Russ., 1938, **12**, 680—681).—A reply to Batschinski (A., 1938, I, 567). J. J. B.

Separation of gases by thermal diffusion. L. J. GILLESPIE (J. Chem. Physics, 1939, **7**, 438, 530—535).—Mathematical. Simple equations are derived for the separation of the components of gas mixtures by thermal diffusion. The equation for a binary mixture gives an upper limit which is in agreement with or slightly > the observed val. Agreement is less satisfactory for mixtures containing H_2 and for very low temp. The separation of heavy species present in a complicated mixture is facilitated by addition of a light gas. W. R. A.

Isotherms of methane–ethane mixtures at 0°, 25°, and 50° up to 60 atmospheres. A. MICHELS and G. W. NEDERBRAGT (Physica, 1939, **6**, 656—662; cf. A., 1936, 1058).—p, d, and pv/RT vals. are recorded for mixtures containing ~20, 40, 60, and 80 mol.-% of C_2H_6. The technique of the measurements is outlined. A. J. E. W.

Leakage of helium through Pyrex glass at room temperature. III. G. P. BAXTER (J. Amer. Chem. Soc., 1939, **61**, 1597; cf. A., 1931, 929).—The rate of leakage of He through Pyrex glass at room temp. has been determined by measuring the loss in wt. of a sealed globe containing He at a pressure originally slightly < atm. Data are recorded for observations extending over 11 years. W. R. A.

Diffusion of hydrogen and deuterium through iron. II. A. GÜNTHER-SCHULZE and A. WINTER (Z. Physik, 1939, **112**, 648—653; cf. A., 1939, I, 193).—Traces of O_2 reduce the diffusion of H_2 through Fe very considerably and must be removed by keeping P_2O_5 in the discharge tube. The influence of admixture of A, Ne, and He, which behave similarly, on the rate of diffusion of H_2 is examined. Obstruction of the Fe with A occurs at 1171 v. with 55% A and at 2157 v. with 20% A; at 273 v. obstruction is almost non-existent. A choked Fe plate becomes permeable again after about 10 hr. at room temp., indicating a slow diffusion of inert gas ions in the Fe. L. G. G.

Thermal conductivity of liquids. D. S. DAVIS (Chem. Met. Eng., 1939, **46**, 356—357).—Nomographs are presented summarising the data on the thermal conductivity of $MeOH$–H_2O, $EtOH$–H_2O, and glycerol–H_2O mixtures. F. J. B.

Properties of saturated aqueous solutions of potassium chloride at temperatures above 250°. M. BENEDICT (J. Geol., 1939, **47**, 252—276).—Equilibrium pressures of the system solid KCl–aq. solution-vapour have been determined between 250° and 600°. A max. pressure of 225 atm. found at 565° affords evidence that crit. phenomena do not occur in aq. solutions saturated with KCl. The sp. vol. of solid KCl and the apparent vol. of H_2O in the saturated solution have also been determined. The sp. vol. of

the liquid phase and the vol. change and latent heat in the reaction H_2O vapour + solid $KCl \rightarrow$ saturated liquid solution have been evaluated. L. S. T.

Properties of electrolytes in mixtures of water and organic solvents. I. Hydrochloric acid in ethyl alcohol- and *iso*propyl alcohol–water mixtures of high dielectric constant. H. S. HARNED and C. CALMON (J. Amer. Chem. Soc., 1939, **61**, 1491—1494).—The effects of different solvent mixtures on the thermodynamic properties of strong electrolytes have been investigated by measuring the e.m.f. of the cells $H_2|HCl$, solvent, $H_2O|AgCl$–Ag in mixtures containing 10 and 20% EtOH and 10% $Pr^\beta OH$ at 25° for [HCl] from 0·005 to 2M. The variation of the standard potential of the cells, evaluated with an accuracy of ±0·05 mv., is discussed as a function of 1/dielectric const. for the above mixtures and for $MeOH$–H_2O, glycerol–H_2O, and dioxan–H_2O mixtures. W. R. A.

Construction of a 10-kw. rotating-anode X-ray tube, and investigation of the structure of salt solutions. J. BECK (Physikal. Z., 1939, **40**, 474—483).—An X-ray tube with an input of 10 kw. is described. It has been used to obtain X-ray scattering diagrams of solutions of $LiCl$, $LiBr$, and $RbBr$ up to high concns. The arrangement of ions in the solution is not irregular, but the results may be explained if it is assumed that the H_2O has a lattice structure into which the ions fit. At higher concns. the lattice structure is similar to that of the hydrated salt. The concn. at which the formation of the lattice occurs varies from one salt to another and can be deduced from the photometer curves. A. J. M.

Diffusion velocity and mol. wt. I. Limits of validity of the Stokes–Einstein diffusion equation. L. FRIEDMAN and P. G. CARPENTER. **II. Effect of p_H on particle size in gelatin solutions.** L. FRIEDMAN and K. KLEMM (J. Amer. Chem. Soc., 1939, **61**, 1745—1747, 1747—1749).—I. By using the Stokes–Einstein diffusion equation the mol. wts. of simple non-electrolytes can be calc. from diffusion coeffs. (D) at infinite dilution determined (1) by examining the vals. of D recorded in " International Critical Tables " (mannitol, lactose, maltose, sucrose, salicin), or (2) by an experimental study of diffusion (glucose).

II. The effect of p_H (0·05 to 6·4) on the D of 3% gelatin solution has been studied at 25°. Between p_H 2 and 6·4 D is almost const., indicating an approx. const. particle size. Below p_H 2, however, there is a rapid decrease in particle size. Addition of KCl to the gelatin solution at different p_H decreases D. W. R. A.

Viscosity of aqueous solutions of strong electrolytes. VI. Viscosity of concentrated aqueous salt solutions containing uni- and bi-valent cations, and the homogeneous equilibrium of reciprocal salt pairs. H. TOLLERT and J. D'ANS (Angew. Chem., 1939, **52**, 472—476).—η and ρ data at 20°, 30°, 50°, and 80° for conc. solutions of inorg. K, Na, NH_4, Ca, and Mg salts and mixtures thereof are recorded, and η and fluidity polytherms for several solutions are reproduced. The application of the

data to the elucidation of equilibrium conditions in mixed salt solutions is discussed. C. R. H.

Coefficient of expansibility of aqueous solutions of carbamide at 27·5° calculated from the densities at 25° and 30°. F. J. GUCKER, jun., and C. E. MOSER (J. Amer. Chem. Soc., 1939, **61**, 1558—1559).—A method has been developed mathematically for calculating the coeff. of expansion of any solution for which d is known as a function of the molarity m at two temp. Equations can also be derived for the apparent and partial mol. expansibilities. The method has been applied to $CO(NH_2)_2$ solutions at 27·5° from known vals. of d at 25° and 30°. The apparent mol. expansibility of $CO(NH_2)_2$ is $\simeq$ that of a uni-univalent electrolyte, although it is $\propto m$ and not to $m^{\frac{1}{2}}$. W. R. A.

Fluorescing power of uranine solutions as a function of their hydrogen-ion concentration. A. BOUTARIC and (MME.) M. ROY (Compt. rend., 1939, **209**, 162—164).—Measurements on buffer solutions (p_H 4·6—10) containing 0·5 g. of uranine per l. show that the fluorescing power first increases with rising p_H, and becomes const. at $p_H > 8·6$. Resorcinol has an inhibiting action on the fluorescence of uranine, independent of its effect on the p_H of the solution. A. J. E. W.

X-Ray study of boric oxide–silica glass.—See B., 1939, 826.

Fine structure of glasses. II. E. KORDES (Z. physikal. Chem., 1939, **B**, **43**, 119—152; cf. A., 1939, I, 250).—A no. of glass systems [binary: P_2O_5–PbO, B_2O_3–Na_2O; pseudo-binary: $MgSiO_3$–$CaSiO_3$, $Pb_3(BO_3)_2$–Pb_2SiO_4, $CaSiO_3$–Na_2SiO_3, $CaSiO_3$–$Na_2Si_2O_5$, $NaAlSi_3O_8$–$CaAl_2Si_2O_8$] are discussed in which the mol. refraction can be calc. from the const. refraction increments of the participating atoms. These exceptions can be predicted on the basis of their special structure or polarisation effects. The mol. vol. of binary acid glasses (SiO_2 and P_2O_5) can be calc. on the basis of structural considerations from the mol. vols. of pure SiO_2- or pure P_2O_5-glasses and the ionic radii of the different atoms. The dependence of the mol. vol. of binary glasses on the composition is illustrated by reference to the systems B_2O_3–Na_2O, SiO_2–Na_2O, SiO_2–PbO, and P_2O_5–PbO. W. R. A.

A fluorite lattice with vacant anion places. E. ZINTL and U. CROATTO (Z. anorg. Chem., 1939, **242**, 79—86).—La_2O_3 takes very little, if any, CeO_2 into solid solution, but CeO_2 forms mixed crystals of CaF_2 structure with >44 mol.-% of La_2O_3. The saturated mixed crystals have a 5·587 A. From vals. for ρ, and from the intensities of the X-ray lines, the mixed crystal formation is of the substitution type, with vacant spaces in the anion lattice, i.e., $1CeO_2$ is replaced by $0·5 La_2O_3$. F. J. G.

Solid solutions in the system zinc sulphide–manganese sulphide. F. A. KRÖGER (Z. Krist., 1939, **100**, 543—545).—Despite chemical and structural similarities in ZnS and MnS favouring solid solutions, at room temp. the series is interrupted between 89 and 20 mol.-% MnS (Schnaase, A., 1933, 341). The products obtained by heating ppts. of

ZnS and green NaCl-type MnS (with KCl) at 800—1200° in an inert atm. have been analysed chemically and by precision powder X-radiograms. Heating at 1180° yields orange photoluminescent solid solutions of hexagonal wurtzite structure up to 52 mol.-% MnS with a a linear function of composition; above this, green MnS separates as a second phase. Below the transition point for ZnS (1020°) solid solutions of wurtzite- or sphalerite-type or both are obtainable, MnS lowering the transition point and producing a range of coexistence for the two phases. I. McA.

Systems nickel ferrite–magnesium ferrite, nickel ferrite–copper ferrite, and nickel ferrite–zinc ferrite. H. FORESTIER and (MLLE.) M. VETTER (Compt. rend., 1939, **209**, 164—167).—The variation of the Curie temp. (Θ) with the composition of the ferrite mixtures prepared by heating the pptd. mixed hydroxides at 1000° (Mg, Cu) or 850° (Zn) is studied. The mixtures give continuous series of solid solutions. A slight peak occurs in the Θ curve with equimol. proportions of NiO,Fe_2O_3 and MgO,Fe_2O_3 or CuO,Fe_2O_3, suggesting the existence of a superlattice containing alternate Ni and Mg (or Cu) atoms. Θ for the third system falls sharply with $<60\%$ of ZnO,Fe_2O_3, and cannot be determined with high contents; ZnO,Fe_2O_3 is thus paramagnetic. X-Ray diagrams show regular variations of the cryst. parameters, but the spinel structure persists throughout. A. J. E. W.

Constitution and microstructure of copper-rich silicon–copper alloys. C. R. SMITH (Amer. Inst. Min. Met. Eng., Tech. Publ. 1073, 1939, 17 pp.; Met. Tech., 1939, **6**, No. 4).—By microscopical examination of quenched samples the domain of the κ phase adjacent to α in the Cu–Si system has been determined. It is formed by peritectoid reaction of α and β at 842° and then contains 5·9 wt.-% Si ($=Cu_7Si$). It decomposes eutectoidally at 552°, when it contains 5·2% Si ($=Cu_8Si$). On the Si-rich side it extends to 6·85% ($=Cu_6Si$) at 785° and 6·95% Si at 729°. The max. extent of the α-phase is to 5·3% at 842°, decreasing to 4·65% ($=Cu_9Si$) at 552° and less at lower temp. Unusual microstructures are observed in the $\alpha + \kappa$ field, for the two phases exist as twin-like plates and do not spheroidise even when grain growth occurs following working and long annealing. The decomp. of κ to $\alpha + \kappa$ at $<552°$ is very slow unless the samples are cold-worked. R. B. C.

Equilibrium diagram of the copper–antimony system. III. Transformations in the solid state. T. MURAKAMI and N. SHIBATA (Sci. Rep. Tôhoku, 1939, **27**, 459—484; cf. A., 1939, I, 138).—Transformations in the solid state of Cu–Sb alloys have been investigated by differential dilatometric and electrical resistance methods. The equilibrium diagram has been revised to include a θ phase which is formed at 58·95% Cu at 440°. D. F. R.

Transformations in copper–palladium alloys. F. W. JONES and C. SYKES (J. Inst. Metals, 1939, **65**, Advance copy, 349—363).—The equilibrium diagram has been determined by X-ray examination of slowly cooled alloys and resistivity measurements during heating and cooling. Alloys with 8—18 at.-%

Pd have a Cu_3Au type of superlattice on slowly cooling and appear to contain anti-phase nuclei; their behaviour is similar to that of Cu_3Au. Cu_3Pd, however, has a tetragonal structure and its ordering process is more complicated than that of Cu_3Au, the sp. heat–temp. and temp. coeff. of resistance–temp. curves of the slowly cooled alloy show max. at 400°, and the disorder–order transformation is very sluggish and is accompanied by marked grain refinement. The α' face-centred cubic phase with superlattice exists over a range from 8 to 18 at.-% Pd up to about 500°, the tetragonal Cu_3Pd phase from 18 to 27 at.-% Pd up to about 450°, and the body-centred cubic β phase from about 36 to 47 at.-% Pd up to 598°; the β-phase region is surrounded by an $\alpha + \beta$ area which becomes narrower with rise in temp. and disappears at 598°.   A. R. P.

X-Ray study of silver–cadmium alloys. E. A. OWEN, J. ROGERS, and J. C. GUTHRIE (J. Inst. Metals, 1939, **65**, Advance copy, 231—246).—The system contains the following phases: α, Ag-rich solid solution; β, body-centred cubic, decomp. on cooling into ζ, close-packed hexagonal; γ, body-centred cubic, 52 atoms per unit cell; δ, close-packed hexagonal; ε, Cd-rich solid solution. The β-transformation occurs at 427° in alloys with 56·3—50% Ag ($\alpha + \beta$ range) and at 445° in alloys with 44·7—40·5% Ag ($\beta + \gamma$ range); pure β alloys transform into ζ at temp. between 427° and 445° according to the composition and there is a very narrow $\beta + \zeta$ field separating the pure β and pure ζ fields. The boundary compositions (% Ag) are as follows: α–($\alpha + \beta$) 56·5% at 450°, 59·1% at 600°, and 61·6% at 700°; α–($\alpha + \zeta$) ~56·5% at 200—400°; ($\alpha + \beta$)–β 50·4% at 450°, 53·6% at 600°, and 54·9% at 650°; ($\alpha + \zeta$)–ζ 49·1—49·7% at 200—400°; β–($\beta + \gamma$) 44·7—43·7% at 450—600°; ζ–($\zeta + \gamma$) 46—45% at 200—400°; ($\beta + \gamma$)–γ 40·4% at 450—600°; ($\zeta + \gamma$)–γ 40·4% at 150—400°; γ–($\gamma + \delta$) 37·2—37·9% at 150—600°; ($\gamma + \delta$)–δ 31·4—33% at 150—600°; δ–($\delta + \varepsilon$) 17·4% at 150—300°; ($\delta + \varepsilon$)–ε 3—6·1% at 100—300°. The γ-phase alloys are very brittle but β alloys quenched from 600° are plastic. The inclination of the ε–($\delta + \varepsilon$) boundary to the vertical indicates that the solid solubility of Ag in Cd at room temp. must be very small.
     A. R. P.

Constitution of magnesium–zinc alloys. F. LAVES (Naturwiss., 1939, **27**, 454—455).—A new temp.–composition diagram for the Mg–Zn system, based on X-ray and microscopical investigations, is given. In addition to $MgZn_2$, homogeneous phases with the approx. compositions Mg_2Zn_3, $MgZn$, and Mg_7Zn_3 have been obtained. They give characteristic powder diagrams.   A. J. M.

Structure of magnesium-rich magnesium–lead alloys. H. VOSSKÜHLER (Z. Metallk., 1939, **31**, 109—111).—The eutectic point is 466°, 66·8% Pb; Mg dissolves 3·7% Pb at 100°, 15% at 300°, 40% at 440°, and 46·2% at the eutectic temp., and the solidus line is slightly concave to the temp. axis.
     A. R. P.

Longitudinal magneto-resistance effect at various temperatures in iron–cobalt alloys. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1939, **27**, 532—

560).—The change in resistance of the alloys of face-centred cubic γ solid solution is $\gg$ that of the alloys of body-centred cubic α solid solution on the Fe side and that of the hexagonal close-packed λ solid solution on the Co side, especially at low temp. In an alloy containing 90% Co the change is 3·8% at −195° with a field of 1500 oersteds.   D. F. R.

Longitudinal magneto-resistance effect at various temperatures in iron–nickel alloys. Y. SHIRAKAWA (Sci. Rep. Tôhoku, 1939, **27**, 485—531; cf. A., 1936, 1332; 1938, I, 569).—The change in resistance of the alloys of face-centred cubic solid solution on the Ni side is $\gg$ that of the alloys of body-centred cubic solid solution on the Fe side, especially at low temp. In an alloy containing 85% Ni the change is 12·8% at −195° with a field of 1500 oersteds.   D. F. R.

System iron–nickel–nickel titanide Ni_3Ti–iron titanide Fe_2Ti. R. VOGEL and H. J. WALLBAUM (Arch. Eisenhüttenw., 1938—9, **12**, 299—304).—The equilibria in the Ni–Ti system up to 30% Ti and in the Ni–Fe–Ti system between the Fe–Ni side and the Fe_2Ti–Ni_3Ti line have been determined by thermal analysis and micrographic examination. Ni_3Ti melts at 1378° and forms a eutectic with Ni at 1287°, 16·2% Ti; Ni dissolves 10·8% Ti at 1250°, 5% at 1050°, and ~2·5% at 20°. The Ni_3Ti–Fe_2Ti system has a eutectic point at 1320°, Ni 41, Ti 25%, and Ni_3Ti dissolves about 18% Fe_2Ti. In the ternary system eutectic valleys run from these two eutectic points and from the Fe–Fe_2Ti eutectic point to the ternary eutectic at 1105°, Ni 42, Ti 20%; in the solid state only four phases exist, viz., α- and γ-Fe and the two compounds, all as solid solutions the composition of which changes somewhat with the temp. Equilibrium diagrams and characteristic microstructures are given.   A. R. P.

Crystal chemistry of alloys : system magnesium–copper–silicon with particular reference to the section $MgCu_2$–$MgSi_2$. H. WITTE (Metallwirts., 1939, **18**, 459—463).—Alloys of compositions lying on the line $MgCu_2$–$MgSi_2$ and containing 0—55% $MgSi_2$ have been investigated thermally, microscopically, and by X-rays. Between 0 and 35% $MgSi_2$ there is a series of solid solutions with structures of the $MgCu_2$, $MgNi_2$, and Mg_2Cu_3Si types. The phase at the composition Mg_2Cu_3Si undergoes a transformation at 870—890°, to a structure of the $MgNi_2$ type. A compound $Mg_6Si_7Cu_{16}$, having a face-centred cubic translation lattice, has been identified.   C. E. H.

Age-hardening of aluminium alloys.—See B., 1939, 844.

X-Ray study of slowly cooled iron–copper–aluminium alloys. II. Alloys rich in aluminium. A. J. BRADLEY and H. J. GOLDSCHMIDT (J. Inst. Metals, 1939, **65**, Advance copy, 195—210; cf. A., 1939, I, 314).—The equilibria in the section of the Fe–Cu–Al system between the Al corner and the line joining the 50 at.-% Fe point on the Fe–Al side with the 50% Cu point on the Cu–Al side are complex; there are 14 single-phase areas, 10 of which are derived from the binary Fe–Al and Cu–Al systems and 4 are ternary solid solutions approximating to the

formulæ $FeCu_{10}Al_{10}$ (ϕ), $FeCu_{10}Al_{18}$ (χ), $FeCu_2Al_6$ (ψ), and $FeCu_2Al_7$ (ω). The phases derived from the binary Cu–Al system are : α (Cu-rich solid solution); γ (Cu_9Al_4) complex cubic; γ_1 ($Cu_{32}Al_{19}$) deformed γ structure; γ_2 (Cu_3Al_2) deformed γ-structure; ζ_2 (Cu_4Al_3) monoclinic; η_2 (CuAl) orthorhombic; θ ($CuAl_2$) tetragonal; κ (Al-rich solid solution). The phases derived from the binary Fe–Al system are : λ_1 (Al_7Fe_2) orthorhombic; μ (Al_5Fe_2) monoclinic; ν (Al_2Fe) monoclinic; β_2 (AlFe) and β_1 ($AlFe_3$) both body-centred cubic with superlattice. Between these small single-phase areas are 29 two-phase and 16 three-phase fields many of which are very long and narrow. The solubility of Cu in Fe at room temp. increases from 0·5% at 0% Al to 5% at 27 at.-% Al and 10% at 36 at.-% Al. The γ phase is in equilibrium with α, β_1, and β_2 and dissolves a max. of 2% Fe, the ϕ phase is in equilibrium with ζ, η, ω, ψ, β_2, and γ_2, the ν phase has a narrow composition range and forms two-phase fields only with β_2 and μ, the μ phase dissolves up to 5% Cu, and λ_2 is in equilibrium with ω, ψ, β_2, and ν. Of the ternary phases ω is in equilibrium with κ, θ, λ_1, λ_2, ψ, χ, η, and θ, and χ with η, β, and ω. A. R. P.

Equilibrium between liquid and gas at high pressures and temperatures. IV. Solubility of air in water and in sodium hydroxide solutions of various concentrations. M. I. LEVINA and N. P. STZIBAROVSKAJA (J. Phys. Chem. Russ., 1938, **12**, 653—659).—Vals. are recorded for the solubility of air, N_2, and O_2 at 100 kg. per sq. cm. between 0° and 240°. The solubility in H_2O shows a min. at 75°; additions of NaOH decrease the solubility and flatten the min. so that in 4N-NaOH the solubility is almost independent of the temp. J. J. B.

Demonstration of an inverted solubility curve. K. A. KOBE (J. Chem. Educ., 1939, **16**, 183; cf. A., 1937, I, 560).—A solution of $MnSO_4$, saturated at 27° and containing 0·5% H_2SO_4 to prevent hydrolysis, is immersed in a freezing mixture, when crystals of $MnSO_4,7H_2O$ soon appear. On heating, the solution becomes clear, and, at the b.p., $MnSO_4,H_2O$ crystallises out. L. S. T.

Use of radio-cobalt for the determination of the solubility of its tervalent salts with α-nitroso-β-naphthol and β-nitroso-α-naphthol. B. N. CACCI-APUOTI and F. FERLA (Annali Chim. Appl., 1939, **29**, 166—169; cf. A., 1939, I, 315).—Using radioactivity technique, the solubilities of the two above-mentioned salts are found to be 1·5 and 0·17 mg. per l., respectively, under the usual analytical conditions. O. J. W.

Mechanism of cation exchange in the montmorillonite–beidellite–nontronite type of clay minerals.—See A., 1939, I, 498.

Occlusion and evolution of hydrogen in pure iron.—See B., 1939, 832.

Gas flow in solids. R. M. BARRER (Phil. Mag., 1939, [vii], **28**, 148—162).—Mathematical. Gas flow by diffusion in combination with phase-boundary processes corresponding with transfer from a gas phase through an adsorbed layer into a solid and vice versa is considered. Surface processes can influence permeability to a considerable extent and large concn. discontinuities at the surfaces are possible. C. R. H.

Diffusion in absorbing media. P. S. H. HENRY (Proc. Roy. Soc., 1939, A, **171**, 215—241).—A mathematical investigation of the problem of diffusion of one substance through another in the pores of a solid body which absorbs and immobilises some of the diffusing substance. The evolution of heat which accompanies the absorption process affects the absorbing power of the solid. The problem arose in connexion with the uptake of moisture by cotton bales, but the theory is also applicable to the case of a dissolved substance diffusing through a gel. G. D. P.

Ageing and formation of precipitates. XXIX. Thermal ageing and abnormal physical properties of fresh silver bromide. I. M. KOLTHOFF and A. S. O'BRIEN (J. Chem. Physics, 1939, **7**, 401—404).—The degree of ageing and of perfection of freshly pptd. AgBr has been followed by measuring the decrease of sp. surface as indicated by the amount of wool-violet adsorbed on the surface saturated with the dye, and by determining the speed of penetration of radioactive Br' into the inactive ppt. The decrease in sp. surface is initially rapid, and for 0·001M-$AgNO_3$ in H_2O, EtOH, and C_6H_6, the rate is not affected by the solvent, and is that of a ppt. kept in the air-dried state at 25°. During the ageing the speed of penetration of radioactive Br', measured by shaking the ppt. with radioactive Br in EtBr, decreases. In fresh air-dried AgBr a rapid exchange occurs between Br' and radioactive Br dissolved in EtBr or Br in the gaseous state. The relatively large electrical conductivity of fresh AgBr indicated by the great thermal mobility is at least partly ionic. W. R. A.

Adsorption by an insoluble substance which is formed in the solution of the adsorbent. G. ROSSI and M. RAGNO (Annali Chim. Appl., 1939, **29**, 135—146; cf. A., 1933, 774).—Measurements have been made of the adsorption of various dyes from aq. solution by $BaCO_3$ (a) produced by pptn. in the solution and (b) suspended directly in the solution. The adsorption curves are markedly different in the two cases, and indicate two different types of adsorption. O. J. W.

Adsorption in metallic solution. L. CONVERS (J. Chim. phys., 1939, **36**, 175—189; cf. A., 1936, 142, 423).—Surface tensions (γ) have been measured by the drop-wt. method for Hg in air (max. 494 dynes per cm.) and in a vac. (417—442), and for dil. amalgams of alkali and alkaline-earth metals in a vac. The difference in the vals. of γ for Hg in air and in a vac. is ascribed to an adsorbed layer of O_2 followed by slow oxidation in the former case, or to surface orientation of Hg atoms in the latter. The γ-concn. curves for the amalgams have two descending branches connected by an ascending branch. These are explained in terms of adsorption and orientation of the solute and of aggregations of Hg and solute. The existence of a rigid film at the surface of the amalgams is noted. F. L. U.

Adsorption of ascorbic acid by lead salts. N. L. LAHIRY and M. SREENIVASAYA (Current Sci.,

1939, **8**, 257—258).—$PbSO_4$ formed by the addition of $Pb(OAc)_2$ to an alcoholic solution of ascorbic acid (I) acidified with H_2SO_4 removes (I) in an amount dependent on p_H (optimum $p_H \sim 3.9$).   L. S. T.

Chromatographic adsorption and dipoles. R. T. ARNOLD (J. Amer. Chem. Soc., 1939, **61**, 1611—1612).—A survey of recorded data has revealed the importance of dipoles in determining the order of adsorption of a mixture on a polar medium. Basicity and acidity of the compounds are not important factors. The no. of isolated dipoles in a mol. is an important factor; picric acid (3 NO_2-groups) is more strongly adsorbed on Al_2O_3 from C_6H_6–light petroleum solutions than is o-$PhNO_2$, although the latter has the larger permanent dipole. Of isomeric mols. containing the same no. and kind of functional groups, those with the larger dipole moment are the more strongly adsorbed on polar media. Where no permanent dipole exists those components with highest polarisability should be the most strongly adsorbed.   W. R. A.

Adsorption of pigments. Specific surface of some zinc oxides. W. W. EWING (J. Amer. Chem. Soc., 1939, **61**, 1317—1321).—The adsorption of Me stearate (I), glycol dipalmitate (II), and glycol tristearate (III) from C_6H_6 solutions by five ZnO pigments (very fine to coarse) has been investigated. Comparison of the data for (I) and (II) indicates that they are adsorbed in the same manner on the solid surface and that the area occupied by the two-chain mol., (II), is $\sim$ twice that occupied by the one-chain mol., (I). Both films are unimol. (or some integral multiple). The amounts of adsorption of the three-chain mol. (III) and stearyl alcohol in conc. solutions are $\gg$ than expected vals., and vary with the solute concn. The mechanism of adsorption of (III) probably differs from that of (I) and (II). The sp. surfaces of the pigments calc. from adsorption data agree with those calc. by the photomicrographic method.   W. R. A.

Adsorptive properties of synthetic resins. II. Adsorption of potassium salts of various anions. S. S. BHATNAGAR, A. N. KAPUR, and M. S. BHATNAGAR (J. Indian Chem. Soc., 1939, **16**, 249—257; cf. A., 1937, I, 234).—Adsorbabilities of various anions of K salts on a resin prepared by acid condensation of CH_2O with m-$C_6H_4(NH_2)_2$ are in the following order: $Cl' > Br' > I'$; $HCO_2' > OAc' > PrCO_2'$; $C_2O_4'' > CH_2(CO_2)_2'' > (\cdot CH_2 \cdot CO_2)_2'' >$ adipate; $MnO_4' > ClO_3' > BrO_3' > IO_3' > CNS'$: $Fe(CN)_6''' > Fe(CN)_6''''$; $Cr_2O_7'' > CrO_4'' > S_2O_3''$. For many of these series the order of adsorbability is the reverse of the order of solubility, but account must also be taken of the size of the anion; e.g., $PhSO_3H$ is both more sol. and more adsorbable than p-$NH_2 \cdot C_6H_4 \cdot SO_3H$.   W. R. A.

Adsorption phenomena at interfaces. M. AUBRY (Compt. rend., 1939, **208**, 2062—2064).—Trillat's method of studying the variation of the interfacial tension (σ) with time is improved by the use of CCl_4 instead of vaseline oil, as steady conditions are reached more rapidly. Cyanine in aq. solution may be determined by measuring σ after a fixed time of contact with CCl_4; the adsorption of cyanine at the interface follows the Freundlich isotherm ($n = 0.22$).   A. J. E. W.

Mechanical properties and stabilising effect of adsorbed layers as a function of their degree of saturation. I. P. A. REHBINDER and A. A. TRAPEZNIKOV (J. Phys. Chem. Russ., 1938, **12**, 573—582).—The rigidity of surface layers of saponin and of palmitic acid (I) in presence of multivalent cations increases with the degree of saturation of the surface layer. The life-time of a bubble under the H_2O surfaces coated by a monolayer shows a max. when the layer is not yet complete; oleic acid is more active than (I) or cetyl alcohol.   J. J. B.

Optical thickness of the transition layer between transparent media. H. D. BRUCE (Proc. Roy. Soc., 1939, **A**, **171**, 411—421).—The theories of Drude and of Maclaurin are shown to reduce to an identical form in which it is not possible to separate the thickness and refractive index of the transition layer.   G. D. P.

Potentials at oil–water interfaces. R. B. DEAN (Nature, 1939, **144**, 32).—Experiments on oil–H_2O potentials with protein films at the interface are described and discussed.   L. S. T.

Boundary surface solutions. H. DUNKEN (Z. physikal. Chem., 1939, **B**, **43**, 240—244).—A description of several old and new experiments on boundary surface solutions.   W. R. A.

Surface skin formation between a hot liquid and a cold wall. H. VON WARTENBERG (Z. Elektrochem., 1939, **45**, 497—502).—Experiments on the behaviour of fused salts, metals, H_2O, and oil in contact with various cooled surfaces indicate that liquids do not wet a surface which is cooled to a temp. below the f.p. of the liquid. Even in a high vac. a definite gap is formed between the cooled surface and the liquid or the crystals deposited from it. If the cooled surface is of the same material as the melt wetting may occur subsequently if the surface of the solid is fused. The wetting and non-wetting of the surface can be detected by the thermal conductivity between the melt and the cooled surface, which is decreased very considerably by the presence of the gap between the two phases.   J. W. S.

Energy relations in transformations from three- to two-dimensional systems. I. Latent heat and entropy of spreading of myristic and pentadecoic acids. W. D. HARKINS and G. C. NUTTING (J. Amer. Chem. Soc., 1939, **61**, 1702—1704).—Using the equation $\Delta H = \lambda_{S \rightarrow F} = T(\delta f / \delta T)(a_F - a_S)$ (f = film pressure at equilibrium between the crystals and the film, and a = area of the surface involved) the latent heats of spreading $\lambda_{S \rightarrow F}$ of crystals (S) of myristic (I) and pentadecoic (II) acids to form a film (F) on $0.01N$-H_2SO_4 have been determined at different temp. The latent heat of spreading for (I) increases approx. linearly with the mol. area, rising from 6020 g.-cal. per mol. at 22.1 sq. A. per mol. to 8060 g.-cal. per mol. at 28.7 sq. A. per mol. The corresponding increment in entropy is from 14.5 to 18.9×10^{-16} erg per degree per mol. The latent heat of spreading for (I) (14 C) is $\sim$1000 g.-cal. per mol. $>$ that for (II) (15 C).   W. R. A.

Properties of unimolecular layers on salt solutions. I. A. I. PANKRATOV. **II.** A. N. FRUMKIN and A. I. PANKRATOV (J. Phys. Chem. Russ., 1938, **12**, 541—548, 549—555).—I. At a const. area the surface pressure and the surface potential of cetyl alcohol and Et palmitate (I) films increase when the underlying solution contains much (1—8 N.) salt. The effect of the salts rises in the series sulphates $<$ chlorides $<$ bromides $<$ iodides.

II. The chemical potential of (I) on various underlying solutions is calc. The calculation makes it probable that the salt effect is due to interaction between the salt ions and the dipoles.	J. J. B.

Spreading of paraffin oils containing fatty acids on aqueous solutions of calcium ions. E. H. MERCER (Proc. Physical Soc., 1939, **51**, 561—565).—The spreading of drops of paraffin oil containing stearic acid on alkaline solutions of $CaCl_2$, during which acid mols. escape from the oil lens, is described; the influence of acid concn., alkalinity, and temp. on the amount of acid shed from the expanding oil drop is investigated, and the mechanism of spreading is discussed.	N. M. B.

Different physical states of protein layers. D. DERVICHIAN (Compt. rend., 1939, **209**, 156—158; cf. A., 1939, I, 317).—Below a certain crit. surface pressure (p 0·2—0·3 dyne per cm.), A-type protein films on H_2O exist in the gaseous state, in which the polypeptide and lateral chains of the mols. lie on the surface. Condensation (p >0·2—0·3 dyne) is not instantaneous, and slow compression of the film, in which two phases coexist, causes a steady increase of p. Condensation is accompanied at first by erection of the non-polar lateral chains (leucine type residues); at $p = \sim$1·5 dyne the peptide groups become detached from the surface and the polypeptide chains become curved, while the polar groups on lateral chains remain on the surface. The film is fluid up to this stage, but at higher p gel formation occurs under the influence of mol. interactions; the elasticity of the gelified film is due to the extensibility of the buckled chains. B-type layers approximate to the normal three-dimensional state of the solid protein, and their high η is due to greater thickness and the cohesive effect of polar groups in the body of the film. B-films, which are disordered on formation, undergo progressive rearrangement on keeping, and tend towards the state of lowest energy. This accounts for the ageing effect. Successive extensions of B-layers increase the no. of polar groups on the surface, causing an apparent increase of mol. area.	A. J. E. W.

Interaction of polycyclic hydrocarbons with sterols in surface films.—See A., 1939, III, 763.

Electrical properties of multilayers. R. W. GORANSON and W. A. ZISMAN (J. Chem. Physics, 1939, **7**, 492—505).—A detailed account of work already noted (A., 1938, I, 615).	W. R. A.

Electrical properties of multimolecular films. H. H. RACE and S. I. REYNOLDS (J. Amer. Chem. Soc., 1939, **61**, 1425—1432).—The electrical properties of multimol. films (Ca, Pb, Ba, Cu, Cd stearates and Cd arachidate), formed by depositing monolayers on a clean polished Cr slide, have been measured with a clean dropping Hg electrode. The dielectric const. of the multilayers is $2·55\pm3\%$ and is independent of the thickness and of the frequency up to 10^6 cycles per sec. The variation is due more to the p_H of the substrate (and thus to the proportion of acid to soap in the film), than to the metal. There is no apparent dependence of dielectric loss on frequency or film constitution. Variations in dielectric strength, which can be obtained as high as 2×10^6 v. per cm., are due probably to the presence of holes, cracks, or dust particles in the films. The electrical properties of skeletonised films agree with the concept of their physical structure.	W. R A.

Surface properties of aqueous solutions of sodium salts of higher alkylsulphonic acids. W. KIMURA, S. NAKANO, and H. TANIGUCHI (J. Soc. Chem. Ind. Japan, 1939, **42**, 121—128B).—It has been established that these Na salts are quite stable in hot, strongly acid solution even at low concn. and show high capillary activity without any tendency to hydrolysis or turbidity.	T. H. G.

Liquid films. (SIR) W. H. BRAGG (Proc. Roy. Inst., 1939, **30**, 687—696).—A lecture.

Surface tension of equimolar solutions. C. SĂLCEANU and H. McCORMICK (Compt. rend., 1939, **208**, 1989—1991).—Measurements on a no. of non-electrolyte solutions show a γ increase of $\sim$0·8 dyne per cm. per g.-mol. of solute per l. The increment is independent of the nature of the solvent or solute. Greater increments are given by electrolyte solutions owing to dissociation, the γ increase being $\sim$0·8 $\times$ (no. of ions per mol. of solute).	A. J. E. W.

Kinetics of the mutual displacement of liquids from the pores of a porous body, and a characteristic of porosity. I. Mutual displacement of liquids in the absence of a meniscus. N. A. FIGUROVSKI (J. Phys. Chem. Russ., 1938, **12**, 619—633).—Charcoal was soaked in Et_2O and immersed in EtOH, and the alteration of its wt. with time was measured. Hence the pore size of the C was calc. Microscopical examination of the C shows that this calculation gives the correct order of magnitude.	J. J. B.

Fog and mist from the physico-chemical standpoint. J. C. PHILIP (Trans. Inst. Chem. Eng., 1938, **16**, 200—208).—The relationship between dusts, smokes, and fogs is outlined. The information derived from detailed chemical investigation of NH_4Cl fogs produced under controlled conditions indicates that the individual droplets can be smaller and the concn. of stable fogs higher than those suggested by previous workers. It is maintained that condensation of a supersaturated vapour depends on the formation of a sufficient no. of aggregates $>$ a crit. size.	F. J. B.

Stability of emulsions. I. Soap-stabilised emulsions. A. KING and L. N. MUKHERJEE (J.S.C.I., 1939, **58**, 243—249).—Emulsion stability is defined as the reciprocal of the rate of increase of the interfacial area of 1 g. of the emulsified material. By means of size-frequency analysis, a large no. of soap-stabilised emulsions has been investigated. The

globules in these emulsions become larger with time. In homogenised emulsions, globules $> 7.5 \mu.$ coalesce, and appear as free oil. The mechanical method of emulsification affects the degree of dispersion and the stability. The effect of added $CaCl_2$ or HCl is to increase the globule size and to decrease the stability. Soaps form fine, but not very stable, emulsions. The emulsifying efficiency decreases in the order, oleate > stearate > palmitate. NH_4 soaps are less efficient than those of Na and K.

Influence of electrolytes on formation of silver chloride sols. I. Coagulating effect of excess of chlorides and their mixtures. L. K. LEPIN and A. V. BROMBERG (J. Phys. Chem. Russ., 1938, **12**, 609—618).—$AgNO_3$ solutions were mixed with chloride solutions, and the concn. of the chloride giving the least turbid sol was determined. For MCl_2 this concn. is ~0·2 of that for MCl, whilst the respective coagulating concns. are in the ratio 1 : 50—1 : 100. Mixtures of MCl and MCl_2 usually possess a smaller coagulating power than does either separately. This antagonistic action of uni- and bi-valent cations is even more pronounced in AgI sols. J. J. B.

Influence of freezing on the formation of structures in colloidal basic aluminium salts. E. I. KVIAT (J. Phys. Chem. Russ., 1938, **12**, 634—638).—Some $Al(OH)_3$ sols coagulate after being frozen. The viscosity (η) of sols having no definite structure is raised by freezing, whilst that of sols possessing abnormal η is lowered. The thixotropy of $Al(OH)_3$ sols is also affected by freezing. J. J. B.

Influence of freezing on the formation of structures in colloidal basic iron salts. E. I. KVIAT (J. Phys. Chem. Russ., 1938, **12**, 660—667).— When a $Fe(OH)_3$ sol has an abnormal viscosity (η), this is lowered by freezing and thawing; if the η is normal it is raised. $Fe(OH)_3$ shows the "kryotropy" of Prakash (cf. A., 1934, 363). The relation between kryotropy and thixotropy is discussed. J. J. B.

Surface tension and thixotropic properties of Putnam clay suspensions. J. W. BELTON (Proc. Leeds Phil. Soc., 1939, **3**, 565—568).—The surface tension of Putnam clay suspensions, measured by the bubble-pressure method, increases with time. The increase, due to thixotropy, is exhibited only by the fractions of the suspensions containing particles between 100 and 200 mμ. D. F. R.

Ion aggregation in solutions of long paraffin-chain salts. G. S. HARTLEY (Kolloid-Z., 1939, **88**, 22—40).—A survey of recent work. F. L. U.

Viscosity and density measurements and X-ray studies of soap solutions. K. HESS, W. PHILIPPOFF, and H. KIESSIG (Kolloid-Z., 1939, **88**, 40—51).—The crit. concn. (C_k) of micelle formation for Na salts of saturated fatty acids up to C_{12}, Na dodecyl sulphate, and Na oleate has been deduced from property–concn. curves. The vals. so obtained agree among themselves where comparison is possible, and with those afforded by X-ray examination. The results indicate that in aq. solution the soaps may exist as simple mols., very small or non-cryst. aggregates, or cryst. micelles. F. L. U.

Macromolecular compounds. CCVIII. Osmotic pressure of aqueous solutions of multivalent acids and their salts with uni- and bi-valent bases. W. KERN (Z. physikal. Chem., 1939, **184**, 302—308).—Osmotic pressure (Π) experiments previously reported (A., 1939, I, 417) have been extended to Li, Na, K, NH_4, and Me-, Et-, Bu^a-, and CH_2Ph-substituted NH_4 salts of a polyacrylic acid (degree of polymerisation 350). For such neutral salts Π is almost independent of the nature of the cation, although for the NH_4 bases there is a slight increase in Π with radical substitution. The $(CH_2\cdot NMe_2)_2$ salt, used as an example of a salt with a bivalent base, shows marked differences from salts with univalent bases. The relation $\Pi = \alpha_k/(b + a\alpha_k)$ (α_k = relative cation concn., a and b consts.) holds for salts of univalent but not for those of bivalent bases, the Π–α_k curve being concave instead of convex to the Π axis. The osmotic coeff.–log α_k curves for the two kinds of salts also show wide differences. The data are discussed with reference to the buffering action of cations as in the earlier papers. C. R. H.

Dielectric investigations on solutions of fibrous molecules. I. SAKURADA and S. LEE (Z. physikal. Chem., 1939, **B, 43**, 245—256; cf. A., 1935, 1319).— Identical solutions in C_6H_6 of mono- and poly-chloroprene, -vinyl acetate, and -styrene have been investigated dielectrically. The ratios of the dipole moments of the synthetic highly polymerised compounds to those of the corresponding monomerides are not only independent of the degree of polymerisation, but are also ~1. Thus fibrous mols. in solution are not rigidly extended, but are soft and flexible. W. R. A.

Influence of inorganic salts on properties of cellulose acetate solutions.—See B., 1939, 812.

Influence of neutral salts on the position of the isoelectric point of gelatin. A. PASSINSKI and I. PETROV (J. Phys. Chem. Russ., 1938, **12**, 556—568). —The rate of cataphoretic migration of the boundary between gelatin sol and gelatin sol + Au sol was measured, and from its dependence on the p_H the isoelectric point was calc. Small concns. of $BaCl_2$ shift this point from 5·06 to 5·4, whilst high [$BaCl_2$] lowers it again. KCNS causes a lowering of the point to 4·90 followed by a rise at high [KCNS]. Ag_2SO_4 and a citrate–phosphate buffer are almost inactive. J. J. B.

Influence of the concentration of gelatin on the position of its isoelectric point. A. PASSINSKI and I. PETROV (J. Phys. Chem. Russ., 1938, **12**, 569—572). —The method previously described (cf. preceding abstract) was used to determine the isoelectric point of 0·2, 0·5, and 1% gelatin solutions, for all of which it was at p_H 4·74—4·76. J. J. B.

Fractional solubility of gluten in sodium salicylate solutions.—See A., 1939, III, 869.

Equilibria in gels. F. MICHAUD (J. Chim. phys., 1939, **36**, 167—174).—Theoretical. The behaviour of gels, other than that due to short-term properties such as elasticity, is adequately accounted for by considering them as solutions of liquids in solids.

Syneresis represents separation of solute from a super-saturated solution.   F. L. U.

X-Ray investigation of silicic acid gels. S. K. Dubrovo (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 50—53).—Silicic acid gels prepared by the action of HCl on a solution of Na silicate and by hydrolysis of $SiCl_4$, although of different p_H, have the same mol. structure, containing crystallites of β-cristobalite and tridymite of dimensions $<10^{-5}$ cm. When heated to 900—950° they give a diagram showing definite cryst. structure. The product from the gel obtained from $SiCl_4$ is a mixture of β-cristobalite and tridymite. The presence of 10% of $CuCl_2$ in the gels does not affect the cryst. structure, but with 10% of $BaCl_2$ crystallisation is favoured.   A. J. M.

Physical chemistry of starch.—See B., 1939, 879.

Mechanism of deformation and fine structure of hydrous cellulose. IX. Theoretical relation between anisotropy of swelling and double refraction of oriented fibres. P. H. Hermans and P. Platzek. **X. "Kratky's chain" as quantitative model for the mechanism of deformation of hydrous cellulose gels.** P. H. Hermans and J. de Booys (Kolloid-Z., 1939, 88, 68—72, 73—78).—IX. Formulæ are derived for the relation between aniso-tropy of swelling and double refraction of oriented fibres, and between each of these quantities and the mean angle of orientation of the micelles.

X. The Kratky model is used as a basis for developing quant. relations between anisotropy of swelling and double refraction on the one hand and degree of extension on the other.   F. L. U.

Effect of non-electrolytes on the time of setting of gelatin gels. L. Friedman and W. N. Shearer (J. Amer. Chem. Soc., 1939, 61, 1749—1751).—Addition of small concns. of non-electrolytes [sucrose, $CO(NH_2)_2$, fructose] increases the setting time of gelatin gels, the effect being max. at 0·02—0·03M. With concns. of non-electrolyte $>0·1M.$ the gels set more rapidly than in absence of non-electrolyte. Comparison of the data with those obtained from a study of the effect of non-electrolytes on diffusion velocity in gelatin gels (cf. A., 1934, 842) indicates that the slower-setting gels have a more open struc-ture.   W. R. A.

Electrolyte coagulation of hydrophobic sols. W. Ostwald (Kolloid-Z., 1939, 88, 1—17).—The author's theory (A., 1936, 157 and later abstracts) of the relation between coagulation and activity coeff. is discussed and further experimental evidence is brought forward to show that the theory gives a satisfactory account of valency effects, ion antagon-ism, "irregular series," and the influence of temp. and change of dispersion medium.   F. L. U.

Rhythmic precipitates. T. Isemura (Bull. Chem. Soc. Japan, 1939, 14, 179—237).—A compre-hensive survey of the subject includes work previously reported (A., 1933, 346, 568; 1934, 840; 1935, 293; 1938, I, 514), and further experiments on the influence of various factors such as temp., gel concn., p_H, etc. A no. of new examples of rhythmic pptn. in gelatin and in SiO_2 gel are described.   F. L. U.

Wave-like character of periodic precipitates. (Sir) C. V. Raman and K. S. Ramaiah (Proc. Indian Acad. Sci., 1939, 9, A, 455—466).—Theoretical. An extended account of work previously reported (A., 1938, I, 514).   C. R. H.

Liesegang rings. K. S. Ramaiah (Proc. Indian Acad. Sci., 1939, 9, A, 467—478).—$AgCrO_4$ rings in gelatin are distinguished as primary and secondary, the latter being of very fine structure visible only under the microscope, and extending throughout the surface, whilst the former are superimposed at wider intervals on the latter, thereby strengthening them and making them visible. Primary rings conform to the outline of the central drop, but the secondary rings are more truly circular. The latter generally start nearer the centre than the former and cease only after all the former have been completed. The continuous structure of the secondary rings cannot be reconciled with the common view that they are due to impurities. Primary rings were not formed by AgCl or Ag_3PO_4 in gelatin nor were secondary rings by PbI_2 in agar. No general conclusions can be reached about the spacing of the rings, but Schleussner's law that the radii of the rings form a simple geometrical progression is a better approxim-ation to the facts than Veil's which states that the square roots of the intercepts between successive rings form an arithmetical series. The closely spaced rings in many of the systems can act as diffraction gratings giving diffraction spectra.   C. R. H.

Action of X-rays on the electrophoretic mobility of colloid particles. J. A. Crowther, H. Liebmann, and R. Jones (Phil. Mag., 1939, [vii], 28, 64—72; cf. A., 1938, I, 617).—The influence of X-rays on the rhythmical variations in the electro-phoretic mobility u of colloidal Au particles of various known sizes has been studied. Both the max. change in u and the dose necessary to produce this change increase strikingly as the radius a of the particles falls. These results are in conformity with the suggestion that the magnitude of the charge gained or lost during irradiation is independent of the particle size. The dose D required to reduce u to a min. is $\propto (a + z)^{-2}$, where z is a const. $\approx 8 \times 10^{-7}$ cm., while that needed to cause a given change in u is of the type $D = Ae^{w/kT}$, where A and w are consts., k is Boltzmann's const., $w = 0·09$ e.v. for graphite and 0·11 for Au.   T. H. G.

Magnitude and determination of potentials due to falling particles during centrifuging of col-loidal solutions. K. Hoffmann (Kolloid-Z., 1939, 88, 17—21).—A device for measuring the potentials is described. In sols of As_2S_3 and TiO_2, centrifuged at 3000 r.p.m., potentials (V) of several mv. were developed. V is $\propto$ (sol concn.) $\times$ (sp. resistance)$/\eta$.   F. L. U.

Deformation of the double layer by the motion of suspended particles. J. J. Hermans (Chem. Weekblad, 1939, 36, 502—508).—A review, parti-cularly of the phenomenon of relaxation in colloidal systems.   S. C.

Thermo-diffusion in liquids. K. Wirtz (Natur-wiss., 1939, 27, 369).—Theoretical. The motion of

particles through liquids by thermo-diffusion is considered on the basis of kinetic and hydrodynamic theory. The former is best applied to particles of which the size and mass are comparable with those of the solvent (*e.g.*, ions in H_2O, or a mixture of liquid isotopes or their compounds), whilst the latter is specially applicable to large particles.   A. J. M.

Law of mass action. A. BOUTARIC (Ann. Soc. Sci. Bruxelles, 1939, [i], **59**, 257—266).—For homogeneous reactions of the type $A + C \rightleftharpoons AC$ and $2A + C \rightleftharpoons A_2C$ simple relations exist between the mol. vols. of the substances taking part and the equilibrium const.   F. L. U.

Thermal dissociation of oxygen. E. H. RIESENFELD (Z. anorg. Chem., 1939, **242**, 47—48; cf. A., 1925, ii, 989).—The formation of O_3, in quantities $\gg$ calc. from the partial pressure of at. O, when pure O_2 is passed through heated quartz capillaries, cannot be purely thermal (cf. Wartenberg, A., 1938, I, 457), and accordingly the author's interpretation still holds.   F. J. G.

Existence of hexamethylenetetramine salts in solution. A. RATTU (Annali Chim. Appl., 1939, **29**, 221—225).—Cryoscopic methods indicate that addition of aq. acids to aq. $(CH_2)_6N_4$ produces partial formation of additive compounds, but this is followed by hydrolysis to CH_2O and NH_4 salts.   F. O. H.

Effect of alcohols on the partial pressure of acetone. J. E. W. RHODES (J.C.S., 1939, 1135—1137).—V.p. measurements have been made on mixtures of $COMe_2$ with *n*-heptyl, benzyl, and *m*-nitrobenzyl alcohols, using the method previously described (A., 1933, 350), the Bremer–Frowein tensimeter, the isoteniscope, and the Ramsay–Young methods. A considerable decrease in v.p. is observed in the presence of substances known to catalyse the Fischer–Giebe alcohol–aldehyde reaction although this reaction actually fails with ketones, the expected acetals being too readily hydrolysed. A similar, though smaller, lowering of the v.p. is observed even in presence of aq. HCl which would favour hydrolysis of the acetals. The observations confirm those of Errera and Seek (A., 1938, I, 342), who suggest that the alcohol–acetone complexes are due merely to dipole interaction; the v.p. evidence, however, suggests that they are acetals.   T. H. G.

Electrical conductivity of solutions containing zinc hydroxide and sodium hydroxide. S. M. MEHTA and M. B. KABADI (J. Indian Chem. Soc., 1939, **16**, 223—228).—Addition of $Zn(OH)_2$ diminishes the equiv. conductance Λ of NaOH owing to formation of Na_2ZnO_2. Na_2ZnO_2 exists in conc. NaOH solution but undergoes hydrolysis on dilution and the $Zn(OH)_2$ is colloidal. Below a crit. concn. $Zn(OH)_2$ separates in cryst. or amorphous forms. This is substantiated by the increased vals. of Λ in dil. solutions.   W. R. A.

Spectrophotometric study of the hydrolysis of ferric salts. J. CATHALA and J. CLUZEL (Compt. rend., 1939, **209**, 43—45).—From the experimental data recorded previously (cf. A., 1939, I, 85, 205) on the ageing of solutions of Fe^{III} salts of varied $[Fe^{\cdots}]$ and $[H^{\cdot}]$ it is inferred that: (i) for a fixed p_H, the

course of the ageing is determined by the $[Fe^{\cdots}]$; (ii) for solutions more acid than a certain p_H (p_H^*) the absorption is const. and independent of time; (iii) the val. of p_H^* increases with decrease in $[Fe^{\cdots}]$; (iv) for media of $p_H > p_H^*$ the absorption varies with time and finally attains a const. val., independent of the p_H, before any turbidity of the solution becomes noticeable; (v) for media of $p_H \sim p_H^*$ a period of induction is observed, whilst at much higher p_H the progress is exponential; (vi) for p_H where the absorption is time-independent a linear relation exists between the concn. of absorbent and the total $[Fe]$ in the solution.   W. R. A.

Ester hydrolysis equilibria: formic acid esters. R. F. SCHULTZ (J. Amer. Chem. Soc., 1939, **61**, 1443—1447).—The hydrolysis equilibrium "consts." for Me, Et, and Pr^{α} formates increase as the proportion of H_2O used increases. In presence of HCl the "consts." also increase with the amount of HCl. The energies of formation of Me, Et, and Pr^{α} formate at 21° are −69,000, −69,000, and −70,300 g.-cal., respectively.   R. S. C.

Thermodynamics of strong electrolytes in protium–deuterium oxide mixtures. II. Potassium chloride. V. K. LA MER and E. NOONAN (J. Amer. Chem. Soc., 1939, **61**, 1487—1491; cf. A., 1939, I, 199).—Measurements at 5°, 25°, and 45° have been made of the temp. coeff. of the cell Ag-AgCl|KCl (*m* in D_2O)|KCl (*m* in H_2O)|AgCl-Ag, to determine the various thermodynamic properties (mol. free energy, entropy, and heat content changes) of the transfer process KCl (in D_2O) = KCl (in H_2O). These properties are interpreted in terms of the difference of solvation energies of the ions in the two solvents. The abs. activity coeffs. of KCl in isotopic mixtures have been calc. (KCl in H_2O at infinite dilution = 1).   W. R. A.

Thermodynamic constants of bromine chloride. Equilibrium reaction between nitric oxide, bromine, chlorine, nitrosyl bromide and chloride, and bromine chloride. C. M. BEESON and D. M. YOST (J. Amer. Chem. Soc., 1939, **61**, 1432—1436).—Using specially purified reagents, the gas equilibrium of BrCl with the various gases given in the title has been investigated in the range 372—492° K. The procedure and necessary corrections are outlined. Vals. of $K = P_{Br_2} \cdot P_{Cl_2}/P_{BrCl}^2$ are given for various temp. By combining the mean val. of K with recorded data for K' (val. of K at room temp.) vals. of ΔH, the heat content change for the formation of 2 mols. of BrCl, are obtained. These differ widely according to the val. of K' chosen. However, spectroscopic data indicate that ΔH is −465 g.-cal. The most probable free energy equation for the reaction, $Br_2 (g) + Cl_2 (g) = 2BrCl$, is $\Delta G_T = -465 - 2.83T$.   W. R. A.

Primary and secondary acids and bases. G. N. LEWIS and G. T. SEABORG (J. Amer. Chem. Soc., 1939, **61**, 1886—1894).—Defining an acid as any substance one atom of which is capable of receiving the basic electron pair of another atom into its valency, co-ordination, or resonance shell, it is necessary to subdivide acids and bases into two categories,

the primary class requiring no energy of activation in mutual neutralisation, and the secondary class requiring considerable energy of activation to bring about combination even between a secondary acid and a primary base and vice versa. The pseudo-acids of Hantzsch are examples of secondary acids, but many substances behave as secondary acids and cannot be classified as pseudo-acids. Neutralisation experiments at temp. down to −160° are described, enabling a large no. of substances to be classified as primary or secondary, strong or weak acids or bases. No new examples of secondary behaviour have been found, but it is suggested that every secondary acid and base exists independently in a corresponding primary form and that the relative amounts of each and their energy differences could be ascertained by kinetic investigations. No satisfactory explanation of the difference in behaviour of the two classes has been found. The most probable hypothesis is that two electromeric forms can exist, incapable of resonance with each other, and differing in the laws which govern electron distribution. W. R. A.

Trinitrotriphenylmethide ion as a secondary and primary base. G. N. LEWIS and G. T. SEABORG (J. Amer. Chem. Soc., 1939, 61, 1894—1900; cf. preceding abstract).—Various substituted CPh_3 cations behave as secondary acids and, by analogy, CPh_3 anions should be secondary bases. In alkaline EtOH solution $CH(C_6H_4·NO_2-p)_3$ gives an intense blue colour due to the $C(C_6H_4·NO_2)_3$ anion (I). When this solution is acidified with AcOH at from −30° to −80° the colour fades slowly and the lower is the temp. the slower is the fading; therefore the blue ion is not behaving as a primary base with respect to addition of an acid at the central C atom. The kinetics of the neutralisation by 13 acids have been investigated; the rates of fading diminish with diminishing acid strength. Over a wide range of acid strength ($CH_2Cl·CO_2H$ to EtOH) the heat of activation is nearly const., with a mean val. of 8·9 kg.-cal. This const. val. is interpreted as the difference in energy between the primary and secondary forms of the base. Since the actual composition of (I) depends on the solvent and on the presence of other solutes, small deviations from the const. val. are found. Although when acid is added to its central C (I) behaves as a secondary base, it behaves as a primary base when acid is added to the NO_2 groups. Thus an orange colour is instantly produced by (I) in presence of strong acids, and its rate of fading has been investigated. Formulæ are proposed for the various products. W. R. A.

Acidic strengths of the stereoisomeric diaquo-diamminoplatinous ions. K. A. JENSEN (Z. anorg. Chem., 1939, 242, 87—91).—In the work of Grünberg (A., 1936, 428) the equilibrium $[Pt(NH_3)_2(OH)_2] + 2Cl' \rightleftharpoons [Pt(NH_3)_2Cl_2] + 2OH'$ may possibly have affected the results. Accordingly the titration curves of solutions of cis- and trans-$[Pt(NH_3)_2(NO_3)_2]$, which contain the ions cis- and trans-$[Pt(NH_3)_2(H_2O)_2]^{··}$, have been determined. The acidity consts. are $K_1 = 2·76 \times 10^{-6}$, $K_2 = 4·79 \times 10^{-8}$ for the cis-compound, and $K_1 = 4·79 \times 10^{-5}$,

$K_2 = 4·17 \times 10^{-8}$ for the trans-compound, in agreement with vals. calc. from the results of Grünberg. F. J. G.

Electrostatic influence of substituents on the dissociation constants of organic acids. I, II. J. G. KIRKWOOD and F. H. WESTHEIMER (J. Chem. Physics, 1939, 7, 437).—Errata (A., 1938, I, 574) are noted. W. R. A.

Dissociation constants of organic acids from solubility measurements. W. V. BHAGWAT (J. Indian Chem. Soc., 1939, 16, 235—238).—Data on $CH_2Cl·CO_2H$, $CHCl_2·CO_2H$, $EtCO_2H$, and $NH_2·C_6H_4·CO_2H$ are recorded. W. R. A.

Dissociation constants of isomeric halogeno- and nitro-anilines and -phenols. H. O. JENKINS (J.C.S., 1939, 1137—1140; cf. A., 1939, I, 321).—A linear relationship exists, with a few exceptions, between the dissociation consts. of these compounds and the electrostatic potential at the C to which the NH_2 or OH is attached. A proof is offered of the proportionality of the mesomeric effect to the inductive effect for each nuclear position in these systems. It is usually stated that the dissociation consts. of the o-substituted anilines are abnormally low, but they conform perfectly to the linear relationship and so must be regarded as normal. The substituted phenols also fail to show the ortho-effect. T. H. G.

Dissociation constants of heterocyclic compounds of the formula $\overline{CR_2·CO·NH·CO·X}$. H. ERLENMEYER and A. KLEIBER (Helv. Chim. Acta, 1939, 22, 851—852; cf. A., 1938, II, 462).—The negative logarithms of the dissociation consts. (p_K) for 2 : 4-diketothiazolidine, 4-keto-2-thionthiazolidine, and 2 : 4-diketo-oxazolidine are 6·77, 5·77, and 5·84, respectively, whilst the corresponding vals. for their 5 : 5-Me_2 derivatives are 6·64, 5·38, and 6·11. No abrupt changes in acidity are observed similar to that between barbituric acid and dimethylbarbituric acid (cf. J.C.S., 1906, 89, 1831). J. W. S.

Equilibria of mercuric oxide in solutions of dilute nitric acid. Evidence for stepwise dissociation of bases. A. B. GARRETT and W. W. HOWELL (J. Amer. Chem. Soc., 1939, 61, 1730—1734).—Dissociation consts. of $Hg(OH)_2$, evaluated from data obtained on the solubility of HgO in aq. HNO_3 (0·00005—0·16M.), agree with the fact that $Hg(OH)_2$ solutions have a very low conductivity and give p_H ~7. They agree also with the data obtained from e.m.f. measurements by Kolthoff. The data indicate that $Hg(OH)_2$ dissociates in a step-wise manner and that the H· and OH′ ions contributed by $Hg(OH)_2$ in aq. solution are < those contributed by the solvent. W. R. A.

[System] trisodium phosphate–sodium fluoride.—See B., 1939, 822.

Binary system sulphanilamide–thymol. U. GALLO and V. BALDINI (Boll. Chim. farm., 1939, 78, 317—320).—The f.p. curve of sulphanilamide (I)–thymol mixtures indicates a eutectic at 2·3% of (I), 48·8°. Partial miscibility of liquid phases occurs with 72·2—41·7% of (I). The mixture with 44·5% of (I)

remains liquid for several days unless seeded with crystals of the eutectic mixture.   F. O. H.

Equilibrium of sodium chloride–sodium chlorate–water systems. A. LINARI (Annali Chim. Appl., 1939, **29**, 189—195).—Data for the mutual solubilities of NaCl and $NaClO_3$ in aq. solution at the b.p. and at normal and reduced pressures are recorded and discussed.   F. O. H.

Mixed crystals in the vitriol series. V. A. BENRATH and E. NEUMANN (Z. anorg. Chem., 1939, **242**, 70—78; cf. A., 1935, 292).—Equilibrium data at 0—100° for the system $NiSO_4$–$MgSO_4$–H_2O are given. Complete series of mixed crystals of the heptahydrates, monoclinic hexahydrates, and monohydrates, and a small range of tetragonal hexahydrate mixed crystals, are found.   F. J. G.

Vanadium oxides. E. HOSCHEK and W. KLEMM (Z. anorg. Chem., 1939, **242**, 63—69).—The phase relationships in the system V–O have been studied by means of X-rays and magnetic measurements. Preps. from VO_2 to $VO_{1.83}$ belong to the α phase, $VO_{1.75}$ to another phase, β, whilst $VO_{1.60}$ shows the lines of β and of V_2O_3 (γ). These relationships resemble those found in the system Ti–O, but the relationships in the region VO_2 to V_2O_5 are not clear. $VO_{2.05}$ shows the lines of VO_2 and also those of another phase, designated α′, whilst $VO_{2.33}$ shows the lines of α′ and of V_2O_5. The preps. are all paramagnetic; ferromagnetism does not occur. The results of the magnetic measurements are not always in agreement with the findings of Perakis (A., 1927, 288, 717, 805). V_2O_3 shows a sharp increase of χ with rising temp. at −100°, whilst in the α and α′ regions this occurs at 65—70°, and without change of lattice structure. The course of the χ-composition isotherms does not clarify the phase relationships in the α–α′–V_2O_5 region, but indicates that if there is any two-phase region between α and β it must be very small.   F. J. G.

Ternary system : ethyl alcohol, toluene, and water at 25°. E. R. WASHBURN, A. E. BEGUIN, and O. C. BECKORD (J. Amer. Chem. Soc., 1939, **61**, 1694—1695; cf. A., 1937, I, 617).—The solubility curve for the ternary system $EtOH$–$PhMe$–H_2O has been determined at 25°. The n of the saturated solutions, and the compositions of various conjugate solutions throughout a large concn. range are recorded.   W. R. A.

Application of physico-chemical analysis to study of the equilibrium of liquid phases in three-component systems. I. **Equilibrium of liquid phases in the system acetic acid–aniline–light petroleum.** E. F. SHURAVLEV (J. Phys. Chem. Russ., 1938, **12**, 639—646).—The phase of composition $2NH_2Ph,AcOH$ is less sol. in, and dissolves more, light petroleum than do any of the phases of near compositions. At the upper crit. point of miscibility the ratio $NH_2Ph : AcOH$ is 3 : 7 by wt. The compound $NH_2Ph,2AcOH$ cannot be detected by solubility measurements.   J. J. B.

Introduction to the phase rule. I. H. G. DEMING (J. Chem. Educ., 1939, **16**, 215—218).   L. S. T.

Heat of formation and specific heat of tantalum nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 437—444).—The sp. heat of TaN has been measured by the ice calorimeter over the temp. ranges 0—99.5°, 0—305.3°, and 0—500.3° and is given by $c = 0.04785 + 7.068 \times 10^{-5}\theta - 5.808 \times 10^{-8}\theta^2$. From these data the heat of formation of TaN at 25° is 58,650 g.-cal.   W. R. A.

Heat of oxygenation of hæmoglobin. See A., 1939, III, 551.

Heats of combustion of mono- and di-saccharides. T. H. CLARKE and G. STEGEMAN (J. Amer. Chem. Soc., 1939, **61**, 1726—1730).—Heats of combustion of six sugars have been measured in a bomb calorimeter standardised with BzOH. The vals., reduced to the standard state $-\Delta U_R$, are : l-sorbose, −670.30; β-d-fructose, −671.70; α-d-galactose, −666.76; β-lactose, −1345.47; β-maltose monohydrate, −1360.50; α-lactose monohydrate, −1354.66 kg.-cal. per mol. for the const.-pressure process at 25°.   W. R. A.

Heat of reaction of thiosulphate with tri-iodide. H. W. ZIMMERMANN and W. M. LATIMER (J. Amer. Chem. Soc., 1939, **61**, 1554—1555).—The heat of dissolution of $Na_2S_2O_3,5H_2O$ at 25° is 11,300±35, heat of dilution 11,170±100 g.-cal. Vals of $\Delta H^0_{298.1}$ for the following reactions are : $2Na_2S_2O_3,5H_2O$ (s) + $I_3' = S_4O_6'' + 4Na^{\cdot} + 3I' + 10H_2O$, 13,760±200; $2S_2O_3'' + I_3' = S_4O_6'' + 3I'$, −8580±250; I_2 (s) + $I' = I_3'$, 820; $2S_2O_3'' + I_2$ (s) $= S_4O_6'' + 2I'$ (I), −7760±250 g.-cal. For (I) $\Delta S^0_{298.1} = 42$, $\Delta G^0_{298.1} = -20,200$ and the potential $E° = 0.44$. $E°$ for $2S_2O_3'' = S_4O_6'' + 2e-$ is −0.10.   W. R. A.

Heats of organic reactions. VIII. **Further hydrogenations, including those of some acetylenes.** J. B. CONN, G. B. KISTIAKOWSKY, and E. A. SMITH (J. Amer. Chem. Soc., 1939, **61**, 1868—1876; cf. A., 1939, I, 28).—The following heats of hydrogenation have been determined (referred to 355° K. in the gaseous phase): (cyclic hydrocarbons) $cyclo$heptene → $cyclo$heptane (I) −26,515±20, $cyclo$heptadiene→ (I) −51,260±49, $cyclo$heptatriene → (I) −72,846 ±10, $cyclo$octene → $cyclo$octane −23,525±35; (cyclic ketones) $cyclo$pentanone → $cyclo$pentanol −12,498±61, $cyclo$hexanone → $cyclo$hexanol −15,424 ±81; (acetylenes) C_2H_2 → C_2H_6 −75,062±66, $CH{:}CMe$ → C_3H_8 −69,703±14, $CMe{:}CMe$ → C_4H_{10} −65,581±130 kg.-cal. per mol. Consideration of the new and recorded data on the heats of addition reactions indicates the magnitude of steric hindrances caused by non-bonded atoms in simple org. mols.   W. R. A.

Reference points and signs in chemical thermodynamics. E. LANGE (Kolloid-Z., 1939, **88**, 89—96).—Existing conventions are discussed and a simplified system is recommended.   F. L. U.

Entropy of electrolyte solutions. Z. SZABÓ (Magyar Chem. Fol., 1936, **42**, 49—54; Chem. Zentr., 1937, i, 1646—1647).—The entropy of an electrolyte solution of concn. Σm_i is given by $S = \Sigma m_i(C_{pi} \log T - R \log a_i + k_i)$, in which C_{pi} is the partial mol. heat and a_i the activity, taken as unity for the pure substance. The const. k_i depends on the

units and the nature of the substance. The calc. S changes on dilution of HCl solutions are in accord with experimental data.   A. J. E. W.

Approximate formulæ for calculation of the free-energy changes and conditions of equilibrium of reactions from thermo-chemical data. H. ULICH (Z. Elektrochem., 1939, 45, 521—533).—Theoretical.   J. W. S.

Thermodynamics of hyponitrous acid. W. M. LATIMER and H. W. ZIMMERMANN (J. Amer. Chem. Soc., 1939, 61, 1550—1554).—The heat of oxidation of $H_2N_2O_2$ by Br and its heat of neutralisation have been measured in 0·001M. solution at 25°. The ionisation consts. at 25° are K_1 9$\pm$2 $\times$ 10⁻⁸, K_2 1·00$\pm$ 0·25 $\times$ 10⁻¹¹. Using these data with estimated entropies of the acid and its ions, provisional vals. of the free energies are calc. to be : $\Delta G^0_{298·15}$ $H_2N_2O_2$ 11,000$\pm$2000, HN_2O_2' 20,400$\pm$2000, N_2O_2'' 35,400$\pm$ 2000 g.-cal. Observations on the stability of aq. $H_2N_2O_2$ and on the rate of reaction with Br are recorded.   W. R. A.

Equilibrium theory of ionic conductance. M. H. GORIN (J. Chem. Physics, 1939, 7, 405—414).—A theory for ionic conductivity is proposed in which the equilibrium between the central ion and its ionic atm. is assumed to be not appreciably distorted by the application of an external field. Ionic radii are thus obtained by extrapolation of conductivity and transference data to infinite dilution. Using these vals. of the radii in the theoretically derived equations, expressions for the conductivity and transference are obtained which agree with experimental data up to 0·02M., and discrepancies at 1·00M. are not large. The correlation of the theoretical ionic radii with the corresponding vals. of Λ_0 is discussed.   W. R. A.

Extrapolation of conductivities of strong electrolytes of various valency types. B. B. OWEN (J. Amer. Chem. Soc., 1939, 61, 1393—1396).—The equation of Onsager and Fuoss (cf. A., 1933, 28) agrees with the conductivity data for 1-1-, 2-1-, 3-1-, 4-1-, and 2-2-valent strong electrolytes for a limited concn. range. This equation therefore allows the extrapolation of the data for multivalent strong electrolytes for which accurate activity coeff. data are not available, and a simple graphical method is described.   W. R. A.

Electrolytic condition of aniline hydrochloride, aniline hydriodide, and α-naphthylamine hydriodide in aniline solution. H. H. HODGSON and E. MARSDEN (J. Amer. Chem. Soc., 1939, 61, 1592—1594).—The mol. conductivities of NH_2Ph,HCl, NH_2Ph,HI, and $\alpha\text{-}C_{10}H_7\cdot NH_2,HI$ have been measured at 15° and plotted against the concn. in NH_2Ph solution. The three graphs are similar and support the assumption of solvate formation, in agreement with the data on phenylation by means of acids or by I (cf. A., 1938, II, 404).   W. R. A.

Calculation of the absolute potential of the calomel electrode from the free energy of hydration of gaseous ions. A. FRUMKIN (J. Chem. Physics, 1939, 7, 552—553).—Polemical against Latimer et al. (cf. A., 1939, I, 202).   W. R. A.

Electrochemical behaviour of mercury in solutions containing foreign ions. P. SZARVAS (Magyar Chem. Fol., 1936, 42, 66—81; Chem. Zentr., 1937, i, 1645—1646).—The potential (E) of Hg in O_2-free solutions depends chiefly on the nature and concn. of the anions, and is $\sim \propto$ log (ion activity). Heavy metal cations raise E, but light metals are without measurable effect. The E max. in the electrocapillary curve is reached with a slowly dropping (" overflowing ") electrode in O_2-free solutions, showing that the difference of potential between the dropping and static Hg electrodes is not a [Hg··] effect, but is due to self-polarisation of the dropping electrode by anion adsorption.   A. J. E. W.

Photovoltaic cells. Spectral sensitivites of copper, silver, and gold electrodes in solutions of electrolytes. P. E. CLARK and A. B. GARRETT (J. Amer. Chem. Soc., 1939, 61, 1805—1810).—The spectral sensitivities of Cu, Ag, and Au electrodes have been determined for monochromatic radiation of from 3650 to 6908 A. The anomalous sensitivity of metals coated with oxide, halide, etc. is attributed to the coatings. A similarity in the mechanism of the photovoltaic and photo-electric effects is suggested from a comparison of the photovoltaic and photo-electric threshold vals. of metals at various stages of out-gassing.   W. R. A.

Theory of diffusion potential. Stationary diffusion and Henderson distribution. L. G. SILLÉN (Physikal. Z., 1939, 40, 466—473).—The general equations governing the state of stationary diffusion between two different solutions of electrolytes are deduced. The Planck differential equations are retained in a more modern form. The conditions under which stationary diffusion with a Henderson distribution will occur are considered.   A. J. M.

Effect of aluminium hydroxide on the overvoltage of hydrogen. F. A. MANUSOVA (J. Phys. Chem. Russ., 1938, 12, 647—652).—In the equation of Tafel $\eta = a - b$ log l for the overvoltage at a Pt electrode, b has the val. 0·10—0·13 in H_2SO_4 at p_H 1·6 but 0·25—0·30 in $Al_2(SO_4)_3$ at p_H 1·7. Similarly it is 0·16—0·17 in NaOH at p_H 11·2 and 0·25—0·30 in $NaAlO_2$ at the same p_H. Colloidal $Al(OH)_3$ seems to alter the double layer on the cathode.   J. J. B.

Electrical properties of organometallic [compounds]. P. BRUN (J. Chim. phys., 1939, 36, 147—159; cf. A., 1938, I, 624).—The formation of organometallic compounds has been studied by measuring the intensity (i) of the current and the p.d. between two electrodes (one of Pt) in a cell containing the reaction mixture. i decreases with the activity of the reaction in the order Mg, Ca, Al. The difference is greatest between Mg and Ca. This order of progression is contrary to that of the usual chemical properties Ca, Mg, Al, but the same as that of the ionisation potentials of the metals.   W. R. A.

Polarographic studies with the dropping mercury cathode. LXXVIII. Electrodeposition of manganese from cyanide solutions. E. T. VERDIER. **LXXIX. Simultaneous occurrence of the two known protein effects**

produced in buffered cobalt solutions. E. JURKA (Coll. Czech Chem. Comm., 1939, **11**, 216—232, 243—255).—LXXVIII. The deposition of Mn from solutions containing excess of Cl', ClO$_4$', CNS', CN', and various buffers has been studied. Contrary to expectation, Mn is easily and reversibly deposited from the complex Mn(CN)$_6$'''' in presence of 1·5N-KCN. With 0·5—1·0N-KCN, hydrolysis is sufficient to produce Mn(OH)CN, and some Mn is deposited reversibly at the first wave and the remainder irreversibly at the second. With 0·1N-KCN no deposition occurs at the first or second waves, but deposition at a third wave due to Mn(OH)$_2$ occurs. The data obtained in buffers support this explanation.

LXXIX. From an examination of the influence of serum and Co salt concns. on the " prenatrium wave " and " double wave " which are shown in current-voltage curves obtained with buffered Co solutions of human blood serum, it is concluded that both waves are due to H$_2$ evolution catalysed by protein SH groups, catalysis in the latter case being activated by Co according to Brdička's theory (A., 1933, 619, 681).
C. R. H.

Polarographic study of reduction of metanil-yellow at a dropping mercury electrode. (MLLE.) H. T. NGA (J. Chim. phys., 1939, **36**, 164—166).—Reduction occurs at all vals. of p_H from 1·92 to 12·32, and its speed decreases as the p_H increases. 2 atoms of H are used for each mol. of the dye. F. L. U.

Influence of concentration on the reduction potential of sulphonated monoazo-dyes at the dropping mercury electrode. (MLLE.) H. T. NGA (Compt. rend., 1939, **208**, 1979—1981).—The reduction potential of orange-2 and five similar dyes in 10^{-5}—10^{-3}N. solution at different p_H (3—11) falls normally as the concn. increases up to an optimum val. (0·4—2 × 10^{-4}N.), and then rises steadily. The reduction processes are thus complex, and their nature is closely related to the dye concn.
A. J. E. W.

Ignition of inflammable gases by hot moving particles. S. PATERSON (Phil. Mag., 1939, [vii], **28**, 1—23).—Whether or not an inflammable gas is ignited by hot surfaces depends on the concn. of the gas, the temp., speed of the particles, etc. An apparatus for examining the effect of speed when the surface is that of a small sphere is described in detail. The results indicate that, with mixtures of coal gas and air and Pt spheres, there is a min. ignition temp. for a given sphere size. This temp. is independent of the richness of the mixture and the age of the sphere and is well above the ignition temp. found with more usual sources of ignition. When the temp. exceeds the min., ignition always occurs unless the speed of the particles is > a crit. val. which varies linearly with temp. The slope of this line decreases as the concn. of coal gas increases from the lower explosive limit until a min. val. is reached, and afterwards increases to the upper explosive limit. Quartz spheres give exactly the same results except that the temp.–crit. speed characteristics are steeper. A simple theory which explains part of the results is given. The problem is of great importance in connexion with accidents in coal mines. T. H. G.

Kinetics of OH radicals as determined by their absorption spectrum. V. Spectroscopic determination of a rate constant. O. OLDENBERG and F. F. RIEKE (J. Chem. Physics, 1939, **7**, 485—492).—The efficiency of recombination of free OH radicals by triple collisions is >1 if the no. of such collisions is calc. from gas kinetic data. The velocity coeff. of the reaction has been determined in abs. units by measuring the intensities of OH absorption lines on Fabry–Pérot plates in the " standard discharge " and combining with f vals. (A., 1938, I, 493). It is concluded that OH radicals form collision complexes which have a lifetime $\gg$ the duration of bimol. collisions between stable mols. W. R. A.

Combustion of aromatic and alicyclic hydrocarbons. II. Ignition of aromatic hydrocarbons at high temperatures. J. H. BURGOYNE (Proc. Roy. Soc., 1939, **A**, **171**, 421—433; cf. A., 1937, I, 522).—The hydrocarbons investigated were C$_6$H$_6$, PhMe, PhEt, PhPr^a, o-, m-, and p-xylene, and mesitylene. The ignition reactions were studied between 450° and 750°. The applicability of the pressure–temp. relation log $(p/T) = A/T + B$ is examined; in three cases A increased with temp. Dilution with N$_2$ decreases the crit. ignition pressure whilst He has the reverse effect. Branching chain mechanisms play an important part in the ignition of C$_6$H$_6$ and its higher monoalkyl derivatives, but with the methylbenzenes the reaction is of a more thermal character. G. D. P.

Spontaneous inflammation of n-hexane–air mixtures. E. FRÉLING and P. LAFFITTE (Compt. rend., 1939, **208**, 1905—1907).—The ignition regions of mixtures containing 7, 6, 4·6, 3, 2, and 1·5% of C$_6$H$_{14}$, for ignition pressures (p) <1 atm., have been studied; typical p-θ curves are given. A region of cold flames with induction periods (τ) of 1—40 sec. occurs at 270—440°, with a min. p val. (80—200 mm. with 7—1·5% of C$_6$H$_{14}$) at 360°. A weak luminescence occurs below this region, particularly at 400—450°. Above 440° a region of more violent ignition, giving a typical lower-limit curve, is observed; τ (1—10 sec.) and the luminosity of ignition are max. at ~540°. With mixtures containing < the stoicheiometric [C$_6$H$_{14}$] (2·16%) an additional broad ignition peninsula is observed below the normal lower limit (p <200 mm.; θ >620°). This region is characterised by quiet inflammation and long τ vals. ($\gg$70 min. with 1·5% of C$_6$H$_{14}$); the region is enlarged and τ is increased by reducing the [C$_6$H$_{14}$]. A. J. E. W.

Combustion of hydrocarbon mixtures. Mixtures of decahydronaphthalene and di$cyclo$pentadiene. P. DUMANOIS, G. REUTENAUER, and M. PRETTRE (Compt. rend., 1939, **208**, 1814—1816).—Di$cyclo$pentadiene (I) does not inflame in O$_2$ at <300°, but both (I) and decalin (II) undergo slow oxidation, at 110—200° and 250—280°, respectively. (II) and (I)–(II) mixtures [$\gg$75% (I)] inflame at <300°; a certain min. concn. of (II) is required with a given O$_2$ pressure, whatever the composition of the (I)–(II) mixture. The max. mixture concn. giving inflammation at <300° is approx. const. with <25% of (I), and decreases with higher concn. of (I). The lower limiting [O$_2$] rapidly increases on substituting (I) for

(II); tetralin (cf. A., 1939, I, 204) has no such effect. It is inferred that chains are initiated by (II), and propagated by both (I) and (II), but participation of (I) in the chain reduces the rate of oxidation and inhibits inflammation. Tetralin has no similar action. A. J. E. W.

Properties of explosive gas mixtures. I. Hydrogen–air and ethylene–air systems. W. S. YOUNG and N. W. KRASE (Trans. Amer. Inst. Chem. Eng., 1939, **35**, 337—358).—Data for the explosive limits, the ratio of max. to initial pressures, the burning velocities, etc. for H_2–air and C_2H_4–air mixtures were confirmed, using a quartz crystal and cathode-ray oscillograph arrangement for measuring the pressure rise in a small spherical explosion chamber. F. J. B.

Thermal chlorination of chloroform. H. A. TAYLOR and W. E. HANSON (J. Chem. Physics, 1939, **7**, 418—425).—The thermal chlorination of $CHCl_3$ has been determined between 260° and 320°, for $CHCl_3 : Cl_2$ ratios from 10 to $\frac{1}{8}$, by a dynamic method which is described. At high $[CHCl_3]$ the reaction is independent of $[CHCl_3]$ and unimol. with respect to Cl_2; at lower $[CHCl_3]$ the reaction depends to a small degree on the $[CHCl_3]$ in addition to the first-order dependence on Cl_2. The following mechanism indicates the general course of the thermal reaction : $Cl_2 \rightarrow 2Cl$, $Cl + CHCl_3 \rightleftharpoons CCl_3 + HCl$, $CCl_3 + Cl_2 \rightleftharpoons CCl_4 + Cl$, and $2CCl_3 + Cl_2 \rightarrow 2CCl_4$. The Cl atoms originate on the walls, and the chains are broken principally in the gas phase. W. R. A.

Thermal decomposition of azomethane. H. A. TAYLOR and F. P. JAHN (J. Chem. Physics, 1939, **7**, 470—473).—The thermal decomp. of azomethane, studied analytically from 292° to 336°, is unimol. with an activation energy of 52,500 g.-cal. per mol. The principal hydrocarbon product is CH_4. For 50 to 90% reaction the end-point (ratio of mols. produced to mols. of azomethane reacted) is const. at 1·95. The formation of $(NMe_2)_2$ as an intermediate, $(NMe_2)_2 \rightarrow N_2 + 2Me$; $(NMe_2)_2 + 2Me \rightarrow (NMe_2)_2$, is postulated. W. R. A.

Thermal decomposition of azomethane in presence of nitric oxide. F. P. JAHN and H. A. TAYLOR (J. Chem. Physics, 1939, **7**, 474—478; cf. preceding abstract).—In presence of large amounts of NO, azomethane (I) decomposes from 295° to 342° with only a small pressure increase. Traces of hydrocarbons are present in the volatile products. This indicates the initial dissociation of (I) into N_2 and Me radicals which combine with NO forming MeNO. That this is oxidised further by NO, giving N_2, H_2O, and CO_2, explains the presence of CO_2 in the reaction products. The ratio of NO to the amount of (I) disappearing is 2 for the upper limit. The energy of activation of the decomp. of (I) alone and in presence of NO is const. W. R. A.

Polymerisation process in a medium with continuously varying discontinuities. J. LÖBER-ING (Naturwiss., 1939, **27**, 457—463).—A review dealing with the various types of polymerisation and the kinetics of the polymerisation process. The effect of change of the physical properties of the reaction medium is considered with particular reference to the formation and decomp. of the polyoxymethylenes. A. J. M.

Rate of decomposition of hydrogen peroxide in nickel sulphate plating baths.—See B., 1939, 845.

Continuity of the kinetics of [reactions in] bleaching liquors. A. SKRABAL (Monatsh., 1939, **72**, 223—243).—The formation of halogenates in hypohalogenite solutions is governed by a general kinetic expression involving two reciprocal velocity coeffs. Λ_1 and Λ_2, viz., $-d\phi/dt = \tau^3\sigma^3[H^\cdot]^3[X']\phi^3/\psi^2\{\psi\Lambda_1[H^\cdot][X'] + \tau\sigma\Lambda_2\phi\}$ ($X = Cl, Br, I$). τ and σ are the equilibrium consts. of the reactions $X_2 + X' \rightleftharpoons X_3'$ and $X_2 + H_2O \rightleftharpoons HOX + X' + H^\cdot$, respectively. $\phi = [X_3'] + [X_2] + [HOX] + [OX']$, representing the effective bleaching concn. of X, and $\psi = [H^\cdot]^2[X']^2 + \tau[H^\cdot]^2[X'] + \tau\sigma[H^\cdot] + \tau\sigma\delta$ ($\delta =$ dissociation const. of HOX). When the conditions are such that the net reaction may be expressed by a single simple equation, it is necessary to retain only one term of each of the above sums, corresponding with the form in which X predominates in the hypohalogenite solution; the remaining terms are negligible or const. A no. of " degenerate " forms of the above expressions are derived by neglecting Λ_1 or Λ_2; these are infrequently obeyed experimentally, but permit a correlation of the velocity and equilibrium consts. The application of the above law is discussed in detail, and tested in typical cases; tentative vals. of Λ_1 and Λ_2 are also given. The mechanism of the reactions is also discussed. A. J. E. W.

Solvent effects in addition reactions. I. Addition of hydrogen bromide and chloride to cyclohexene and Δ^γ-hexene. S. F. O'CONNOR, L. H. BALDINGER, R. R. VOGT, and G. F. HENNION (J. Amer. Chem. Soc., 1939, **61**, 1454—1456).—Addition of HCl and HBr to cyclohexene and Δ^γ-hexene is much faster in xylene, C_6H_6, $PhNO_2$, $CHCl_3$, or heptane than in Et_2O or dioxan. This is due to attraction of the " negative " addendum (Cl or Br) to the donor O. Dielectric consts. bear no relation to the reaction rates. R. S. C.

Reaction kinetics of filiform molecules in solution. I. Alkaline saponification of polyvinyl acetates. S. LEE and I. SAKURADA (Z. physikal. Chem., 1939, **184**, 268—272).—The saponification of mono- and of two poly-vinyl acetates (degrees of polymerisation 280 and 920) is bimol., the velocity coeffs., heats of activation, no. of collisions, and probability factors for each compound being the same and equal to the corresponding vals. for EtOAc. C. R. H.

Mechanism of solvolytic reactions of organic halides and the use of activity coefficients in the equation for a reaction velocity. P. D. BARTLETT (J. Amer. Chem. Soc., 1939, **61**, 1630—1635).—Polemical against Olson and Halford (A., 1938, I, 86) and Bateman et al. (A., 1939, I, 86). W. R. A.

Reactions between thiophen and calcium hypochlorite solutions. E. G. R. ARDAGH, W. H. BOWMAN, and A. S. WEATHERBURN (J.S.C.I., 1939, **58**, 249—251).—The two principal reactions between

hypochlorite solution and thiophen are: (1) the formation of chlorothiophens; (2) fission of the ring with oxidation of the S to SO_4''. At p_H 4·1 at room temp., and with a molar ratio of 5 OCl′ : 1 C_4H_4S, 23—24% of the S is oxidised to SO_4'' in 30 min., whilst 76—77% of the thiophen is chlorinated. With increasing initial p_H vals. up to p_H 8·0 the proportion of thiophen oxidised increases. At p_H 8, 41% of the S was oxidised. With OCl′ : C_4H_4S ratios >5 : 1, the % of the total S oxidised increases to an upper limit of ~90% at 80 : 1 ratio and at p_H 8·0. With increase in the time of contact the proportion of the S oxidised increases somewhat.

Hydrolysis of guanidine by boiling potassium hydroxide solution.—See A., 1939, II, 410.

Velocity of crystallisation of sucrose. J. Dubourg and R. Saunier (Bull. Soc. chim., 1939, [v], 6, 1196—1208).—A method for measuring the rate of growth of a single crystal in a supersaturated solution is described. The crystal is placed in a wide tube containing the solution into which dips a plunger tube, closed at its lower end with a disc of optically plane glass, sufficiently wide to permit the entry of a microscope objective. The outer tube dips into a thermostat. Two dimensions of the crystal can be measured periodically without disturbance of the solution. The increase in the linear dimensions of a sucrose crystal $\propto$ time and is independent of the state of development of the crystal. The velocity of crystallisation (v) under any specified conditions can be defined as the wt. of sucrose deposited in unit time on unit crystal surface. The effects on v of variations of temp., concn., and p_H of the solution, and of the presence of glucose, caramel, NaCl, $CaCl_2$, and $Ca(NO_3)_2$ have been investigated. Agitation promotes the crystallisation of sucrose solutions owing to the production of nuclei. J. W. S.

Rate of growth of iodine crystals in foreign gases. M. Pahl (Z. physikal. Chem., 1939, 184, 245—267).—The foreign gases used were air, CO_2, and H_2, and the pressure was varied within the range 38—740 mm. Hg. The rate of I crystal growth, v, increases with reduction in pressure, extrapolation to zero pressure giving the same val. for each gas examined, viz., $0·82 \times 10^{-3}$ cm. per sec. for the linear rate of growth of the crystal surface. The calc. accommodation coeff. is 0·016 at 15° and an I pressure 5 mm. Hg. The influences of diffusion and of mol. layers of adsorbed foreign gas on v are discussed. C. R. H.

Kinetics of absorption of oxides of nitrogen by alkaline solutions. V. I. Atroschtschenko (J. Appl. Chem. Russ., 1939, 12, 167—181).—The velocity of absorption of N oxides by aq. alkalis (NaOH or Na_2CO_3) is max. for mixtures in which [NO] = [NO_2], and rises with increasing concn. of oxides and of alkali, with increasing velocity of flow of the gas, and with increase in the effective surface of absorption. R. T.

Oxidation of sulphides by oxygen-enriched air. III. Oxidation of zinc sulphide. N. P. Diev and J. V. Karjakin (J. Appl. Chem. Russ., 1939, 12, 188—195).—The reaction of oxidation of

ZnS by atm. O_2 consists almost exclusively in 2ZnS + $3O_2 \rightarrow$ 2ZnO + $2SO_2$. At 500° the velocity of the reaction is independent of the [O_2] of the air, and is very small. At temp. >700° the velocity rises rapidly with increasing [O_2], 97% conversion being achieved after 15 min. at 900°, with 60% O_2. R. T.

Rate of formation of ammonium benzoate. (Mme.) D. Markowska and G. Valensi (Compt. rend., 1939, 208, 1648—1650).—The formation of NH_4OBz from gaseous NH_3 and needle crystals of BzOH follows the relation $kt/d_0^2 = (4·167 + m)\log (1 + 0·24m) + (1 - m)\log(1 - m)$ (d_0 = mean diameter of needles; m = fraction of total BzOH consumed) (cf. A., 1935, 1466). The rate of neutralisation is max. at 30°. The const. k is $\propto$ (NH_3 pressure)$^{0·6}$. A. J. E. W.

Rate of formation of α-naphthylamine hydrochloride. (Mme.) D. Markowska (Compt. rend., 1939, 208, 1727—1729).—The reaction between gaseous HCl and powdered α-$C_{10}H_7$·NH_2 (I) at const. temp. (0—45°) follows the equation $kt/e_0^2 = 6·2056 - (1 - m)^{\frac{2}{3}} - 5·2056(1 + 0·1921m)^{\frac{1}{3}}$, where m = fraction of (I) transformed into hydrochloride, and e_0 = mean diameter of particles. The rate is min. at 25°. The reaction is of the second order with respect to HCl. A. J. E. W.

Speed of nitrification of calcium carbide.—See B., 1939, 823.

Nature of catalysts. C. N. Hinshelwood (J.C.S., 1939, 1203—1212).—A lecture.

Reaction between hydrogen and oxygen sensitised by nitrogen peroxide. R. G. W. Norrish and F. S. Dainton (Nature, 1939, 144, 30—31).—Addition of foreign gas to an explodable mixture of H_2, O_2, and NO_2 of const. composition progressively lengthens the induction period and eventually converts the ignition into a slow reaction. The relative amounts required to quench ignition are A : N_2 : He : CO_2 = 6 : 3·6 : 3 : 1; the effectiveness in lengthening the induction periods is in the reverse order. At a given temp., increase in the pressure of the reactants causes the upper limit for ignition to rise to a max. and then to fall, and the lower limit to fall, less markedly, to a min. and then to rise. Explanations of these results are discussed. L. S. T.

Kinetics of the non-explosive and explosive reaction between hydrogen and oxygen sensitised by nitrogen peroxide. II. G. von Elbe and B. Lewis (J. Amer. Chem. Soc., 1939, 61, 1350—1355).—In the explosive reaction between H_2 and O_2 in presence of NO_2, no sp. reaction mechanism so far proposed which is based on the thermal theory describes the effect of pressure and mixture composition on the upper crit. [NO_2]. The mechanism derived previously on the basis of the isothermal branched-chain theory (cf. A., 1937, I, 621) has been extended to describe the observations of Foord and Norrish (cf. A., 1936, 34) on the induction periods in the explosive and non-explosive reactions. This theory fits experimental facts most satisfactorily. W. R. A.

Influence of nitrogen peroxide on the two-stage ignition of hydrocarbons. G. P. Kane

(Proc. Roy. Soc., 1939, A, 171, 251—269).—Experiments were carried out on C_3H_8, n-C_4H_{10}, and MeCHO mixed with O_2 at pressures < 1 atm. to determine the min. ignition pressure and time lag at different temp. Observations were also made on C_3H_8–air mixtures at higher pressures to confirm the influence of NO_2 on "knock" in internal-combustion engines. The results are in agreement with the view that NO_2 promotes a direct oxidation $A \rightarrow C$ at high temp. but inhibits the two-stage reaction $A \rightarrow B \rightarrow C$, predominant at low temp., by neutralisation of the active intermediate product B.   G. D. P.

Mutarotation of xylose. (MLLE.) M. MURGIER and E. DARMOIS (Compt. rend., 1939, 209, 42—43).—In pure H_2O and in different buffer solutions the mutarotation of xylose, at 20° for the green Hg line, follows a logarithmic law, log $(\alpha_t - \alpha_\infty)$ being a linear function of the temp. The speed of the reaction (K) for the buffer solutions K H phthalate–phthalic acid varies with the p_H, and the curve K–p_H resembles that for glucose. The curvature of this curve diminishes as anion concn. decreases, and at the same time the val. of the min. of K tends to that in H_2O, i.e., 0·22. Thus the negative ions of weak acids catalyse the mutarotation. For the acetic, phthalic, and phosphoric buffer mixtures K varies with the anion at const. p_H. The catalytic effect of the anions on the mutarotation is in the order $H_2PO_4' >$ phthalate ion $>$ OAc'. At const. p_H the catalytic effect of strong acids on the mutarotation is $HClO_4 \gg$ $PhSO_3H \gg$ HCl.   W. R. A.

Acid catalysis in non-aqueous solvents. VII. Rearrangement of N-bromobenzanilide in chlorobenzene. R. P. BELL and O. M. LIDWELL (J.C.S., 1939, 1096—1099).—Data obtained at 25° for the rearrangement of NBrBzPh (I) when catalysed by 8 org. acids are recorded. The catalytic consts. at infinite dilution, k_A, are related to the dissociation consts. of the catalysing acids, K_A, by $k_A = 0·0078 K_A^{0·51}$. The general behaviour is similar to that of NBrAcPh (II) with the exception that (II) is transformed more slowly than (I) with the stronger acids, although with the weaker acids the reverse is the case.   C. R. H.

Homogeneous and α-Ag_2S-catalysed hydrogen sulphide reaction. H. REINHOLD, W. APPEL, and P. FRISCH (Z. physikal. Chem., 1939, 184, 273—301). —Between 350° and 550° the velocity coeff., k, of the homogeneous combination of H_2 and S at a glass surface is given by the empirical relation $k = ([H_2S]\sqrt{V^3}/[H_2]\sqrt{[S]})\{1 + ([H_2S]/[S])\}$, where V is the streaming velocity. The data support the views of Bodenstein and of Porret, who proposed the scheme $S_8 \rightarrow 4S_2$; $S_2 \rightarrow 2S$; $H_2 + S \rightarrow H_2S$. When catalysed by α-Ag_2S the velocity coeff. is given by $k_1 = ([H_2S]\sqrt{[S]}\sqrt{V})/[H_2]v$, where v is the vol. of the reaction vessel. k_1 is also $\propto$ the area of the catalyst surface. Conductivity measurements on the catalyst show that it contains principally adsorbed S and little adsorbed H_2. H_2 mols. which strike the catalyst surface are adsorbed and combine immediately with the adsorbed S. k_1 is small in comparison with the velocity of adsorption of S by the catalyst.   C. R. H.

Catalytic interaction of acetone and iso propyl alcohol with deuterium on platinum. A. FARKAS and L. FARKAS (J. Amer. Chem. Soc., 1939, 61, 1336—1341).—$COMe_2$ is reduced readily to C_3H_8 by D_2 in presence of platinised Pt foil at ~150 mm. pressure and from $-42°$ to 89°. Very little Pr^βOH is formed. Above 0° an exchange reaction between $COMe_2$ and D_2 occurs simultaneously with the reduction, but this reaction ceases below $-10°$. The reduction of Pr^βOH to C_3H_8 by D_2 is slower than that of $COMe_2$ under the same experimental conditions. An exchange reaction is also observed which proceeds by two stages : the H atoms of the $>$CH·OH group are exchanged, and subsequently those of the Me groups. The assumption of three independent reactions is sufficient to explain the different reduction and exchange reactions occurring in the system $COMe_2$-Pr^βOH-D_2 : (a) reduction of $COMe_2$ to C_3H_8, (b) establishment of the equilibrium $CHMe_2$·OH $\rightleftharpoons$ $COMe_2 + H_2$, and (c) the exchange reaction of $COMe_2$ with D_2.   W. R. A.

Homogeneous catalytic formation of mono- and di-vinylacetylene from acetylene. H. SCHMITZ and H. J. SCHUMACHER (Z. Elektrochem., 1939, 45, 503—517).—The polymerisation of C_2H_2 to mono- (I) and di-vinylacetylene (II), catalysed by various mixtures of HCl, NH_4Cl, and Cu_2Cl_2, has been studied at total pressure 1—2·5 atm. and at 60—110° by a circulation method. The total yield of polymerides increases with increasing rate of stirring of the solution (r), but the yield of (II) decreases both with increasing r and with increasing rate of passage of the gas (v). Beyond certain min. vals. of r and v, however, the total yield of polymerides and the proportions of (I) and (II) become approx. const. for any particular catalyst mixture, the total yield being $\propto$ the partial pressure of C_2H_2, i.e., $\propto$ the $[C_2H_2]$ in the solution. With const. $[C_2H_2]$ the yield is also $\propto$ the $[Cu_2Cl_2]$. Replacement of NH_4Cl by NH_4Br reduces the yield considerably, apparently owing to the formation of Cu_2Br_2, which is less active than Cu_2Cl_2. The yields of (I) and (II) are unaltered by mixing the C_2H_2 with CO, CH:CCl, or CH_2O or by adding $FeCl_2$ to the catalyst. The relative yields of (I) and (II) are also unaltered by covering the solution with xylene, which is a good solvent for (I). In contact with a solution containing Cu_2Cl_2, C_5H_5N, and AcOH, C_2H_2 appears to undergo a different form of polymerisation of undetermined nature.   J. W. S.

Catalysis. L. D. JOHNSON (J. Chem. Educ., 1939, 16, 238—239).—Apparatus and method for demonstrating the oxidation of MeOH to CH_2O using CuO as catalyst are described.   L. S. T.

Isomerisation of alkenes on alumina and thoria. S. GOLDWASSER and H. S. TAYLOR (J. Amer. Chem. Soc., 1939, 61, 1762—1765).—The comparative rates of isomerisation of several olefines have been measured on ThO_2 and Al_2O_3 catalysts at ~400°, and the products of the isomerisation determined. The mode of prep. affects only the physical state of the catalyst and has no appreciable effect on the isomerisation. At this temp. the straight-chain olefines are the most unstable, Δ^α-hexene and Δ^α-heptene giving a large no. of isomerides on Al_2O_3. C_7 olefines iso-

merise faster than C_6 olefines. The main isomerisation observed is the migration of a Me group across a double bond. All β-Me compounds give the corresponding γ-Me compound in large amounts, but the reverse migration occurs only to a slight extent. A mechanism postulating an intermediate three-ring structure similar to that proposed for the dehydration of alcohols (cf. A., 1939, II, 401) accounts for the products of isomerisation.　　　　W. R. A.

Aromatisation of heptane, heptene, and hexene isomerides on chromic oxide. S. GOLDWASSER and H. S. TAYLOR (J. Amer. Chem. Soc., 1939, **61**, 1766—1769).—The dehydrogenation of *cyclo*-hexene and -hexadiene on Cr_2O_3 gel surfaces has been investigated. The effect of temp. and treatment of the catalyst on the yield of C_6H_6 has been studied. The fastest rate of conversion of n-C_7H_{16} into PhMe on Cr_2O_3 gel is 9 c.c. per hr. With ThO_2 and Al_2O_3 catalysts there is no aromatisation, indicating the difference between dehydrogenating and isomerising catalysts. The influence of structure of olefines on poisoning, aromatisation, and disproportionation has been demonstrated.　　　　W. R. A.

Mechanism of polymerisation reactions. I. Polymerisation of styrene and methyl methacrylate. R. G. W. NORRISH and E. F. BROOKMAN (Proc. Roy. Soc., 1939, A, **171**, 147—171).—The rate of polymerisation of $CH_2\!:\!CMe\cdot CO_2Me$ and styrene has been measured, with and without catalyst, in the temp. range 80—130°. The rate of co-polymerisation of the two substances was also investigated. The change of mol. wt. during the course of polymerisation of the pure substances was measured. In the absence of catalyst the rate of polymerisation is slow and is believed to be due to the presence of adventitious catalysts. It is concluded that the reaction is started by free radicals derived from the catalyst, and is propagated by way of a free valency at the end of the growing chain. The growth of the chain may be terminated by hydrogenation at the expense of the monomeride, resulting in the starting of a new chain by the monomeric free radical thus produced.　　　　G. D. P.

Comparison of the catalytic activities of the two allotropic forms of nickel. G. LE CLERC and H. LEFEBVRE (Compt. rend., 1939, **208**, 1650—1651). —Reduction of CO by H_2 in presence of cubic Ni is retarded at 170°, and eventually ceases owing to the production of the hexagonal form (A., 1939, I, 428). C_6H_6, C_2H_2, and $COMe_2$ are not reduced in presence of hexagonal Ni. The catalytic activity is restored by heating at 250° to re-form cubic Ni. The inactivity of the hexagonal form may be related to its non-ferromagnetic properties.　　　　A. J. E. W.

Contact sulphuric acid manufacture.—See B., 1939, 821.

Heterogeneous catalysis of sulphonation of benzene with sulphur trioxide.—See B., 1939, 804.

Elimination of acetylene from gases.—See B., 1939, 799.

Catalysts for synthesis of liquid hydrocarbons. —See B., 1939, 803.

Separation of the isotopes of chlorine by electrolysis. K. V. YACOUBYAN (Helv. Chim. Acta, 1939, **22**, 808—809).—By electrolysis of a mixture of HCl and NaCl containing initially 36 kg. of Cl′, 24 g. of Cl′ of at. wt. 0·016 > that of normal Cl have been obtained.　　　　J. W. S.

Silver–silver carbonate electrode obtained by electrolysis. P. DEMERS (Canad. J. Res., 1939, **17**, A, 77—81).—The electrode is made by using a Ag anode in the electrolysis of dil. $NaHCO_3$ solution. Immersion of the Ag_2CO_3-coated electrode in a Na_2CO_3–$NaHCO_3$ solution gives a reproducible potential of −0·4679 v. and a solubility product of $1\cdot27 \times 10^{-11}$.　　　　D. F. R.

Preparation of lanthanum by electrolysis of its fused chloride. F. WEIBKE [with J. SIEBER] (Z. Elektrochem., 1939, **45**, 518—520).—Pure La_2O_3 (x g.) is dissolved in the theoretical vol. of conc. HCl and NH_4Cl (1—1·5x g.) is added. The solution is stirred vigorously while it is evaporated to dryness. The residue is powdered finely and heated slowly to expel most of the NH_4Cl. Electrolysis is carried out in a graphite crucible within which is enclosed an Al_2O_3 crucible to separate the anode and cathode compartments. The graphite crucible serves as anode and a rotating Mo rod as cathode. KCl and CaF_2 are added to the $LaCl_3$ as fluxes. Optimum yields are obtained by electrolysis at 1000° with c.d. 7 amp. per sq. cm.　　　　J. W. S.

Electrodeposition of a thin layer of powdered substances. J. H. DE BOER, H. C. HAMAKER, and E. J. W. VERWEY (Rec. trav. chim., 1939, **58**, 662— 665).—The finely-ground substance is suspended in MeOH, EtOH, BuOH, or $COMe_2$, and deposited by electrophoresis. High voltages may be used.　　　　F. J. G.

Principles of the genetic formation of materials. XII. Cathodic deposition of metals in solid electrolytes. V. KOHLSCHÜTTER and E. STOCKER (Helv. Chim. Acta, 1939, **22**, 869—894).— The crystal forms of the metals deposited by electrolysis of solid $PbCl_2$, $PbBr_2$, PbO, AgCl, and α-AgI have been examined. Difference in behaviour is observed according as the potential used is ~ 60 v, or > 500 v. When the electrodes used are unattacked the current–p.d. curve for $PbCl_2$ obeys Ohm's law if the p.d. is > the decomp. potential.　　　　J. W. S.

Electrolytic production of very pure nickel from alloys. G. G. MONSELISE (Helv. Chim. Acta, 1939, **22**, 935—937).—The alloy (>60% Ni) is dissolved anodically at 60° in a solution which is maintained at p_H 0 by addition of H_2SO_4, using a c.d. of 10 amp. per sq. dm. Under these conditions most of the Cu is deposited at the Pb cathode. To the solution is added sufficient MnO_2 to oxidise all the Fe to Fe^{III} and the H_2SO_4 is neutralised by addition of $CaCO_3$. After filtration the solution should be free from Fe and Cu. It is finally electrolysed at 75—90° between a graphite anode and a pure Ni cathode, with a c.d. of 6—8 amp. per sq. dm., the solution being maintained neutral by addition of $CaCO_3$. A pure adherent and homogeneous deposit of Ni is formed.　　　　J. W. S.

Electrolytic preparation of manganese. I. P. B. SHIVOTINSKI and S. A. ZARETZKI (J. Appl. Chem. Russ., 1939, **12**, 200—208).—Mn is obtained by electrolysis of solutions containing $MnCl_2,4H_2O$ 350 g. and NH_4Cl 100 g. per l., in 0·03N-HCl, at 10—25° and p_H 1·2—1·3 (Fe, Cu, or Al cathode, graphite or Pt anode, with alundum diaphragms; c.d. 250—1000 amp. per sq. m.), or $MnSO_4$ 80, $(NH_4)_2SO_4$ 150, and SO_2 0·05—0·4 g. per l., at 20—30° and p_H 4—7 (cathode Fe, anode Pt or graphite, with linen or porcelain diaphragms; c.d. 200—750 amp. per sq. m.). R. T.

Influence of titanium salts on electrolytic reduction of ferric sulphate. K. J. GRATSCHEV (J. Appl. Chem. Russ., 1939, **12**, 196—199).—Electrolytic reduction of $Fe_2(SO_4)_3$ to $FeSO_4$ is considerably accelerated by addition of $TiOSO_4$ (5 g. TiO_2 per l. of solution). R. T.

Electrolytic oxidation. XI. **Electrolysis of acid–ester salts in non-aqueous solutions, and the mechanism of the Crum-Brown–Walker synthesis.** A. HICKLING and J. V. WESTWOOD (J.C.S., 1939, 1109—1114).—The efficiency, E, of the electrosynthesis of $(CH_2 \cdot CO_2Et)_2$ from $CO_2Et \cdot CH_2 \cdot CO_2K$ in $(CH_2 \cdot OH)_2$ is $<$ for aq. solutions and appears to be only slightly affected by changes in c.d. or in the material of the anode. E falls approx. linearly with the addition of H_2O to $(CH_2 \cdot OH)_2$. Metallic salts which inhibit the synthesis in aq. solution have a negligible effect in $(CH_2 \cdot OH)_2$. $CO_2Et \cdot CH_2 \cdot CO_2'$ ions directly discharged at the anode are supposed to combine to form $(CO_2Et \cdot CH_2 \cdot CO \cdot O \cdot)_2$ which decompose to $(CH_2 \cdot CO_2Et)_2$ and CO_2 or else react with $(CH_2 \cdot OH)_2$ to form $CHO \cdot CH_2 \cdot OH$ and $CO_2Et \cdot CH_2 \cdot CO_2H$. Experiments on the thermal decomp. of $(CO_2Et \cdot CH_2 \cdot CO \cdot O)_2$ and its reaction with $(CH_2 \cdot OH)_2$ support this view. C. R. H.

Application of electrolytic polishing to micrographic examination of iron and steels.—See B., 1939, 845.

Electrochemistry of rare metals.—See B., 1939, 845.

Anodic oxidation of copper and brass.—See B., 1939, 845.

Emission of ultra-violet radiation by electrolysis of solutions of azoimide and sodium azide. R. AUDUBERT and E. T. VERDIER (Compt. rend., 1939, **208**, 1984—1986).—Measurements with a CuI photon counter show that ultra-violet radiation of intensity given by $J = aIe^{aV}$ is emitted from the anode during electrolysis of 0·5—1·5M-HN_3 and 0·2—0·6M-NaN_3. As the p_H rises, the const. α first decreases and may become negative ($p_H \sim 7$), and then increases. The influence of the anode potential, V, on J indicates that the activation energy of the N_3 radicals, which undergo secondary photogenic reaction, is partly determined by kinetic activation by the electric field. The emission bands correspond with those observed during pyrolysis of azides (A., 1939, I, 481), and the emission is due to an electronically activated N_2 group (which possibly has a metastable state of long life) returning to its normal state. A. J. E. W.

Volume and surface processes in the oxidation of nitrogen in glow discharge. I. B. A. KONOVALOVA and N. I. KOBOZEV (J. Phys. Chem. Russ., 1938, **12**, 521—540).—At a pressure of 4 mm. Hg the rate of oxidation of dry N_2 by O_2 shows a max. at 80% N_2. H_2O decreases the rate between 45 and 95% of N_2 and increases it at other [N_2]; 2% of H_2O is as active as 1%. CH_4 inhibits the reaction $>$, and NH_3 and $H_2 <$, H_2O. An increase of the solid surface (quartz, glass, or mica) accelerates the oxidation, especially in the presence of H_2O. It is supposed that NO is produced partly on the walls, this part of the reaction being inhibited by dipole mols., and partly in space. H_2O or NH_3 does not affect the latter part since they do not alter the emission spectrum of the discharge. J. J. B.

Optical sensitising of silver halides by dyes. II. **Mechanism of optical sensitising and the quantum equivalent.** S. E. SHEPPARD, R. H. LAMBERT, and R. D. WALKER (J. Chem. Physics, 1939, **7**, 426—436; cf. A., 1939, I, 315).—The photolysis of AgBr sensitised with certain acid and basic dyes has been followed by the chemical and photometric determination of the liberated Ag. In absence of halogen acceptors the dye is progressively bleached, whilst in presence of halogen acceptors the dye is unaffected. The max. sensitivity is considerably $<$ adsorption saturation and at approx. the same adsorption density for both photolysis and photographic sensitivity. At higher adsorption densities a desensitising action of sensitising dyes is due to the ease of rebromination by the dye–Br additive compound. The initial quantum equiv. is 1 if the photographic yield $\propto$ the adsorption density of the dye. In sensitising, photovoltaic experiments indicate the release of photoconductance electrons (from the adsorbed dye, or from the Br' ions of the AgBr receiving energy from the photo-activated dye). W. R. A.

Photographic latent image from the standpoint of the modern theory of solids. J. H. WEBB (Proc. Sixth Conf. Spectros., 1938, 157—167).—The theory of latent image formation proposed by Gurney and Mott is reviewed. The theory is tested experimentally. The effect of low temp. on the sensitivity of an emulsion has been investigated. At $-186°$ the sensitivity is $\ll$ at room temp. The breaking up of an exposure into a no. of smaller ones, with intermittent warming up from $-186°$ to room temp., increases the sensitivity almost to that at room temp. This is strong evidence in support of the Gurney–Mott assumption that electrolytic transport of $Ag\cdot$ constitutes the secondary process of latent image formation. The Herschel effect (erasure by infra-red light of the action of previous exposure to white light) has been investigated at various temp. If a white light exposure is made at 20°, followed by a Herschel exposure at $-186°$, no Herschel effect was obtained, but when the white light exposure is made at $-186°$, and the Herschel exposure at 20°, the Herschel effect is considerable. These facts can be readily explained on the Gurney–Mott theory, which also offers a plausible explanation of the failure of the

reciprocity law at high intensity. The degree of failure diminishes as the temp. is lowered. A. J. M.

Sensitivity of photographic films to X-radiation at very low temperatures. J. REEKIE (Proc. Physical Soc., 1939, **51**, 683—688).—Investigations at temp. obtainable with liquid N_2, H_2, and He indicate that the sensitivity decreases uniformly down to ~100° K., below which the decrease becomes less rapid until at temp. <20° K. the sensitivity remains almost const. at a val. $\gg$ that found for visible light (cf. Berg, A., 1939, I, 89). It is suggested that the relatively high X-ray val. indicates that a considerable no. of free electrons must be formed by the absorption of the X-radiation while the film is at low temp. N. M. B.

Interpretation of the mechanism of a thermal decomposition from photochemical evidence. H. A. TAYLOR and M. BURTON (J. Chem. Physics, 1939, **7**, 414—417).—A transition in polyat. mols. permitted between two energy hypersurfaces in a radiative act is forbidden (by analogy with diat. mols.) in a non-radiative process. The thermal decomp. of MeCHO into CH_4 and CO in a unimol. primary process is hence not allowed, and for CH_4 and CO to be formed in a primary process it must be in a reaction of the type $MeCHO + M \rightarrow CH_4 + CO + M$, where M = another mol. or an external field. The simultaneous occurrence of such a decomp. and a free radical decomp. adequately accounts for many of the observations on the catalysed and high-pressure reactions. W. R. A.

Reactions of methyl radicals with deuterium, ethane, neopentane, butane, and *iso*butane. J. O. SMITH, jun., and H. S. TAYLOR (J. Chem. Physics, 1939, **7**, 390—396).—Me radicals, produced by the photolysis of $HgMe_2$, were allowed to react with D_2, C_2H_6, n-C_4H_{10}, iso-C_4H_{10}, and CMe_4 and the amounts of CH_4 and C_2H_6 formed have been determined. The plot of log k_{CH_4} against $1/T$ is a straight line for all the reactions (k_{CH_4} = rate of formation of CH_4). In the interaction between $HgMe_2$ and H_2 or D_2, both in absence and in presence of H_2 or D_2, the formation of C_2H_6 remains unchanged; formation of CH_4 increases with temp. and so does the rate of decomp. of $HgMe_2$. Formation of C_2H_6 shows first-order dependence on light intensity, whilst formation of CH_4 shows an order between one-half and the first power, tending towards the first power with increased temp. Packing the vessel at 200° decreases the amount of CH_4 formed but does not affect the amount of C_2H_6, and the rate of decomp. of $HgMe_2$ is independent of its concn. A mechanism which satisfies all these facts is put forward. For the reactions with hydrocarbons the suggested mechanism is (i) Me + RH = CH_4 + R; (ii) R + Me = RMe; (iii) Me + Me = C_2H_6. From the rate of formation of CH_4 the following activation energies for the reaction of Me with hydrocarbons have been deduced, assuming zero activation energy for C_2H_6 formation: C_2H_6 and CMe_4, 8·3; n-C_4H_{10}, 5·5; iso-C_4H_{10}, 4·2 kg.-cal. The differences in activation energies are attributed to differences in bond energies, particularly because of the closely analogous differences in the heats of hydrogenation

of substituted ethylenes (Kistiakowsky *et al*, A., 1938, I, 199). W. R. A.

Conversion of light into chemical energy. E. RABINOWITCH (Proc. Sixth Conf. Spectros., 1938, 143—149).—Examples of photochemical reactions in which light is converted into chemical energy are given. The extent of such conversion in org. reactions is small, but may be considerable in ionic reactions such as the formation of the latent image in a AgBr–gelatin emulsion. Reactions of inorg. compounds in the extreme ultra-violet often show a 50% conversion of light into chemical energy. The most efficient process of conversion is met with in C assimilation, where it reaches 70—80%. This high degree of conversion is remarkable, since the reaction must occur by the successive absorption of 4 quanta, and with the formation of three intermediate products. Reasons for the failure to bring about photosynthesis *in vitro* are discussed. Sensitisation, catalysis, and quantum accumulation by resonance transfer assist in the efficient utilisation of light energy. Reversible photochemical reactions are also considered. A. J. M.

Photochemistry of the visual spectrum. F. WEIGERT (Proc. Sixth Conf. Spectros., 1938, 134—142).—The phenomenon of photodichroism is discussed. It is due to the presence of minute dichroic and light-sensitive particles which are affected selectively when their optic axes are oriented to correspond with vibrations of polarised light. Film dichroism, observed in coloured collodion films, is also discussed. Experiments on film dichroism and its variation after exposure of the film to natural light show that there are two types of dichroic particles. In the first type the anisotropic and dichroic properties are forced on the dye particles by the binding medium (collodion, gelatin), whereas in the second type the dichroism is independent of the medium. The dichroism of AgCl–gelatin and AgBr–gelatin emulsions with a slight excess of Ag· is discussed. The sp. action of coloured light on AgCl emulsions is due entirely to the presence of dichroic particles of the second type. A. J. M.

Photo-oxidation of hydrocarbon solutions. E. J. BOWEN and A. H. WILLIAMS (Trans. Faraday Soc., 1939, **35**, 765—771).—Fluorescence efficiencies and fluorescence quenching by O_2 (cf. A., 1939, I, 123) have been compared with the quantum efficiencies of photo-oxidation for 17 aromatic hydrocarbons dissolved in C_6H_{14}, C_6H_6, or m-xylene. Quenching and oxidation represent similar processes in C_6H_6, all Me-substituted C_6H_6 except C_6Me_6, and rubrene, whilst in the others the oxidation efficiency is $\ll$ the fluorescence quenching would indicate. F. L. U.

Emission of ultra-violet radiation and pyrolysis of thallium azide. R. AUDUBERT and C. RACZ (Compt. rend., 1939, **208**, 1810—1811; cf. A., 1938, I, 431).—Radiation is not emitted by TlN_3 during pyrolysis in N_2. In 2—10 mm. of O_2, radiation commences at 206±5°; the activation energy of the photogenic process is 43,000 or 21,600 g.-cal. for temp. < and >228±8°, respectively. With O_2 pressures >10 mm., radiation commences at 267±3°, and the activation energy is 65,800 g.-cal., the process evidently

involving oxidation of Tl. No emission is observed during oxidation of Tl, and the radiation is thus due to the N; the emission bands [2040, 2140, 2280, 2390, 2500, 2650 (?) A.] correspond with excited levels of the N_2 mol. Tl inhibits the photogenic reaction.   A. J. E. W.

Splitting of protein molecules by ultra-violet light and α-rays.—See A., 1939, III, 868.

Detonation of nitrogen iodide under the action of α-rays from polonium. M. HAÏSSINSKY and R. J. WALEN (Compt. rend., 1939, **208**, 2067—2069).— N iodide (I) detonates on exposure to Po after a period which increases rapidly as the intensity of the source is reduced, and is decreased by drying the specimen. $Pb(N_3)_2$, AgN_3, and diazo-*m*-nitroaniline perchlorate are not detonated. Detonation is due to local heating of favoured (I) particles by the α-rays, the particle size being an important factor in determining the resulting temp. rise.   A. J. E. W.

Molecular compounds—inorganic and organic. J. S. ANDERSON (J. Proc. Austral. Chem. Inst., 1939, 6, 232—242).—A review.

Chemical separation of the isotopes of hydrogen. L. H. REYERSON, O. JOHNSON, and C. BEMMELS (J. Amer. Chem. Soc., 1939, **61**, 1594—1595).— Separation of H_2 and D_2 has been carried out by the action of H_2O of various D_2 content on CaC_2 in an all-glass apparatus which is described (cf. A., 1936, 427).   W. R. A.

Improved universal buffer. W. C. JOHNSON and A. J. LINDSEY (Analyst, 1939, **64**, 490—492).— 6·008 g. of citric acid, 3·893 g. of KH_2PO_4, 1·769 g. of H_3BO_3, and 5·266 g. of diethylbarbituric acid form a solid mixture to be made up to 1 l. with H_2O. Solutions of any p_H between 2·6 and 12·0 may be prepared by titrating with 0·2N-NaOH free from CO_3''.   E. C. S.

Preparation of potassium iodide by double decomposition.—See B., 1939, 822.

Hydrates of cupric oxide. O. BINDER (Compt. rend., 1939, **208**, 1995—1998; cf. A., 1923, ii, 321).— Differential thermal analysis of CuO,H_2O gives no indication of endothermic dehydration reactions yielding other hydrates, tho only marked heat absorption occurring on decomp. CuO,H_2O, which is stable in absence of alkali, is thus the only definite hydrate (cf. A., 1932, 238; 1938, I, 366).   A. J. E. W.

Formation of copper ferrite at low temperature. H. FORESTIER and (MLLE.) J. LONGUET (Compt. rend., 1939, **208**, 1729—1730).—Microcryst. Fe_2O_3,CuO, possessing normal ferromagnetic properties, with a Curie point at 455°, is obtained by boiling the pptd. hydroxides with H_2O for ~24 hr. The reaction does not occur in absence of H_2O, or with partly dehydrated or cryst. hydroxides.   A. J. E. W.

Trifluoroacetates. F. SWARTS (Bull. Soc. chim. Belg., 1939, **48**, 176—191; cf. A., 1923, i, 292).— $CF_3 \cdot CO_2Na$ (I) and $CuSO_4,5H_2O$ [or $Cu(NO_3)_2$], followed by extraction with Et_2O, gives *Cu trifluoroacetate* $[(CF_3 \cdot CO_2)_2Cu]_2$, very hygroscopic (*dihydrate* formed in moist air); evaporation of an aq. solution

at 100° (bath) gives insol. basic salts (II). The Et_2O extract of a solution conc. under reduced pressure, and pptd. with light petroleum, affords a ppt., which when dried and treated with H_2O, or extracted with dioxan, gives a residue of the *complex*, $(CF_3 \cdot CO_2)Cu,3CuO,H_2O$, or $[(CF_3 \cdot CO_2)_3OH]Cu_2$, respectively; the latter is obtained also from (I) and dioxan (as residue). (I) and $AgNO_3$ give $CF_3 \cdot CO_2Ag$ (*loc. cit.*), which with C_6H_6 affords $(CF_3 \cdot CO_2Ag)_2,C_6H_6$. Hg_2CO_3 and $CF_3 \cdot CO_2H$ (III), or (I) and $HgNO_3$, give $(CF_3 \cdot CO_2)_2Hg_2$. (III) and HgO give $(CF_3 \cdot CO_2)_2Hg$ (IV); the *dihydrate* at 105° gives $(CF_3 \cdot CO_2)_2Hg,HgO$. (IV) and hot C_6H_6 give *HgPh trifluoroacetate*, $CF_3 \cdot CO_2HgPh$, m.p. 123·7°. (III) and Tl_2CO_3 give Tl¹ trifluoroacetate, m.p. 120·5°, b.p. ~160°/1·5 mm. (liquid phases with C_6H_6 are examined). $(CF_3 \cdot CO_2)_2Ba,3H_2O$ (V) and $Al_2(SO_4)_3$ [with some (III)] give $(CF_3 \cdot CO_2)_2AlOH$; the neutral salt was not obtained. (III) and PbO give an impure Pb trifluoroacetate. (V) and $FeSO_4$ (evaporated in H_2) give $(CF_3 \cdot CO_2)Fe$ (*trihydrate*). (III) and $Fe(OH)_3$ afford $[CF_3 \cdot CO_2)_6(OH)_2Fe_3]CF_3 \cdot CO_2$ (VI), which loses H_2O to give $CF_3 \cdot CO_2[Fe(CF_3 \cdot CO_2)_6O]$. The orange-red aq. solution of (VI) is decolorised by adding (III). (III), pure or a conc. solution, and (VI) give a complex trifluoroacetate. Solutions of (VI) are decomposed by ultra-violet light (mechanism suggested). Ni (+ $5H_2O$) and nitron trifluoroacetates are recorded.   A. T. P.

Reactions of beryllium chloride. Normal and basic organic salts of beryllium. G. B. FIELD (J. Amer. Chem. Soc., 1939, **61**, 1817—1820).—A mixture of 500 g. of sucrose and 50 g. of BeO was evaporated until it became a viscous syrup. This was ignited and allowed to burn without further heating. The residue, BeO + C, was crushed and placed in a Pyrex reaction chamber embedded in an electric furnace. Preheated Cl_2 (admixed with an equal vol. of N_2) was passed over the BeO–C mixture and reaction took place at ~550°. Anhyd. $BeCl_2$ passed over as a smoke. Anhyd. $BeCl_2$ reacts, in dry C_6H_6, with org. acids or acid anhydrides to give the normal salts, $(RCO_2)_2Be$, if H_2O is rigorously excluded. Even traces of H_2O cause hydrolysis to the basic salt, $(RCO_2)_6Be_4O$, according to the equation $4(RCO_2)_2Be + H_2O = (RCO_2)_6Be_4O + 2RCO_2H$. The following have been prepared : normal formate, m.p. 150° (decomp.), acetate, m.p. 294—296° (decomp.), propionate, m.p. 75—78° (decomp.), *benzoate*, m.p. 307—309° (decomp.), and *o-chlorobenzoate*, m.p. 245—249° (decomp.); basic formate, glassy, acetate, tetrahedral, m.p. 283—284°, propionate, monoclinic prismatic, m.p. 133—134°, butyrate, b.p. 225°/25 mm., *benzoate*, pinacoidal triclinic, m.p. 317—318°, and *o-chlorobenzoate*, prisms, m.p. 255—256°.   W. R. A.

Beryllium chloride in organic reactions.—See A., 1939, II, 411.

Ammoniacal calcium phosphide, $Ca(PH_2)_2,6NH_3$. C. LEGOUX (Compt. rend., 1939, **209**, 47—49; cf. A., 1938, I, 633).—A known vol. of PH_3 was bubbled into a dil. solution of Ca in liquid NH_3 at −70°. A white microcryst. ppt. (I) was formed with liberation of H_2. Qual. and quant.

analysis of the gas liberated by (I) at 0° indicates 1 mol. of H_2. (I) is therefore $Ca(PH_2)_2,nNH_3$. Contrary to the behaviour of the K, Na, and Li compounds, (I) is scarcely sol. in liquid NH_3. It is spontaneously inflammable in air. Attacked by air-free H_2O or by dil. HCl in vac. it gives off 2 mols. of PH_3 (not spontaneously inflammable). It has a dissociation pressure in liquid NH_3 of 46 mm. Hg at 0°. At this pressure it gives off 4 mols. of NH_3, leaving an amorphous white powder (II). This is also spontaneously inflammable and is attacked by excess of dil. HCl in vac. liberating 2 mols. of PH_3 with formation of $CaCl_2$ and NH_4Cl (2 mols.). (I) is thus $Ca(PH_2)_2,6NH_3$ and (II) $Ca(PH_2)_2,2NH_3$. (II), which has no appreciable pressure at ordinary temp., decomposes above 45° with liberation of NH_3 and PH_3.
W. R. A.

Water softening.—See B., 1939, 788.

Separation of liquid mixtures in the Clusius separation tube. (Separation of zinc isotopes.) H. KORSCHING and K. WIRTZ (Naturwiss., 1939, 27, 367—368).—An improved apparatus for the separation of liquids by the method of Clusius involving thermo-diffusion is described. The efficiency of the method when applied to the separation of various types of liquid mixture is examined. The application of the method to the separation of a mixture of 50% C_6H_{14} and 50% CCl_4 is described, the difference in concn. (Δn) of CCl_4 at the upper and lower ends of the tube being determined at different times (t). At first $\Delta n \propto t^{\frac{1}{2}}$, but the curve rapidly becomes flatter, although a limiting val. is not reached. For a tube of length h, $\tau = h^2/\pi^2 D$, where D is the diffusion const. and τ the time required to attain equilibrium. The separation of H_2O–D_2O mixtures is also considered. The sedimentation of salts in aq. solution can also be effectively carried out with the apparatus, and the method is applied to the separation of $^{64}ZnSO_4$, $^{66}ZnSO_4$, and $^{68}ZnSO_4$. Although the time during which the separation was carried out was short, a definite separation was effected and confirmed spectroscopically. The separation of heavy mols. from light ones is shown to be possible by the partial separation of Sudan I (mol. wt. ~350) from CCl_4, and of chlorophyll (mol. wt. ~1000) from H_2O.
A. J. M.

Aluminium silicofluoride. A. A. SANFOURCHE and A. KRAPIVINE (Compt. rend., 1939, 208, 2080—2082).—$Al_2(SiF_6)_3,9H_2O$ is obtained in small yield by treating aq. $PbSiF_6$ with neutral aq. $Al_2(SO_4)_3$; traces of Pb are removed from the filtrate by H_2S and the solution is evaporated at room temp., any pptd. SiO_2 being removed. (I) forms hexagonal prisms which twin readily and resemble cryst. Na_2SiF_6; $3H_2O$ are lost at >300°, and decomp. commences at 500°. Aq. (I) is acid, and decomposes when heated or neutralised.
A. J. E. W.

Action of water vapour on amalgamated aluminium. M. BLUMENTHAL (Bull. Acad. Polonaise, 1938, A, 466—477).—The surface of an amalgamated Al sheet is not homogeneous and the reaction with water vapour takes place on active centres. The activity of the centres depends on the structure and composition of the solid phase. The product is $(Al_2O_3,3H_2O),(n - 3)H_2O$. If n is <3 the centres become passive and the reaction can be completely arrested. Below 75° the temp. coeff. is negative owing to the slow adsorption of H_2O vapour. At temp. >75°, however, the mean energy of the active centres increases and the temp. coeff. becomes positive.
W. R. A.

Bi- and quadri-valent compounds of the rare earths. IX. Ytterbous [selenide and telluride]. H. SENFF and W. KLEMM (Z. anorg. Chem., 1939, 242, 92—96).—Yb^{II} telluride, YbTe, and selenide, YbSe, have been obtained by heating $YbCl_2$ with excess of Te or Se in a stream of H_2. They are black powders, which are slowly oxidised by moist air. They have the NaCl structure, with a 6·340 A. for YbTe and 5·867 A. for YbSe. The radius of the $Yb^{\cdot\cdot}$ ion is therefore ~ that of the $Ca^{\cdot\cdot}$ ion. Attempts to obtain Sm^{II} telluride by the same method gave products containing only ~25% of Sm^{II}.
F. J. G.

Cobalticyanides of the rare earths; preparation and magnetic properties. T. KARANTASSIS, C. VASSILIADIS, and N. PERAKIS (Compt. rend., 1939, 208, 1720—1721).—$M^{III}[Co(CN)_6]$ (M = La, Ce, Pr, Nd, Sm, Yb, or Yt) is pptd. on adding $K_3[Co(CN)_6]$ or the acid to aq. MCl_3 or $M(NO_3)_3$. Solubilities in H_2O and 0·1N-HCl at 18° are given, and vals. of χ and χ_A at 79—295° K. are recorded. The Curie points are : M = Ce, −58°; Pr, −62°; Nd, −59°. The at. moments are 11·8, 16·0, and 17·5 Weiss magnetons, respectively.
A. J. E. W.

Preparation of cyanogen iodide. H. T. COMASTRI (Anal. Asoc. Quím. Argentina, 1939, 27, 45—47).—I with aq. KCN gives an 86% yield of CNI, m.p. 149° (sealed tube).
F. R. G.

Reaction of carbonic acid with the zeolite in a water softener.—See B., 1939, 788.

Action of sulphides on very dilute solutions of permanganate. E. MONTIGNIE (Bull. Soc. chim., 1939, [v], 6, 1191—1195).—Pptd. PbS, HgS, Bi_2S_3, SnS_2, CdS, CoS, CuS, ZnS, and UO_2S all react rapidly with dil. aq. $KMnO_4$, yielding the oxide of the metal, K_2SO_4, and hydrated MnO_2. The reaction is accelerated by agitation and by addition of small amounts of acid. Only slow decolorisation of the $KMnO_4$ is produced by As sulphides formed by the wet method and by SnS_2 formed by fusion of Sn with S. No reaction is observed with FeS, ZnS, Sb_2S_3, or HgS formed by the dry method or with MnS, SnS, Ag_2S, WS_3, and MoS_3 produced by pptn.
J. W. S.

Action of liquid ammonia solutions of sodium, potassium, and potassium amide on bismuth oxyiodide. G. W. WATT and W. C. FERNELIUS (J. Amer. Chem. Soc., 1939, 61, 1692—1694).—Liquid NH_3 solutions of Na and K at room temp. reduce BiOI according to BiOI + 3M + $NH_3 \rightarrow$ Bi + MI + MOH + MNH_2 (M = Na, K). Excess of M causes the formation of bismuthides. KNH_2 reacts thus : BiOI + $KNH_2 \rightarrow BiONH_2$ + KI.
W. R. A.

Thermal method for the separation of isotopes. A. BRAMLEY and A. K. BREWER (J. Chem. Physics, 1939, 7, 553—554).—Separation chambers of concentric glass tube design 1 m. and 3 m. long were used to study the isotope separation of a 50% NH_3–

CH_4 mixture at 25 cm. pressure. The change in the separation factor (f) (the ratio of the initial to final concn.) for a definite time is independent of the height of the tube if separation is $<90\%$ of the final equilibrium concn. The final equilibrium val. of f is $\propto$ the height of the tubes. For the 3-m. tube the variation in separation at different heights indicates that the ratio of concns. of the two components is const. for several cm. from the bottom but that for greater distances f alters considerably. The mass speed is independent of tube length. f is not changed by withdrawing 8 c.c. (at n.t.p.) of gas per hr. For the 1-m. and 3-m. tubes f is 1·3 and 2·0 respectively. Addition of an inert gas of the same mass to give initially a 50% (mass) mixture leads to increased efficiency of separation of a component of low concn. In the NH_3–CH_4 mixture $^{13}CH_4$ has the same val. of f as $^{14}NH_3$.   W. R. A.

Vanadium selenides. E. HOSCHEK and W. KLEMM (Z. anorg. Chem., 1939, **242**, 49—62).—By heating V_2O_3 in a stream of H_2 containing H_2Se, followed by further heat-treatment in a vac. or with excess of Se, *V selenides* ranging in composition from VSe to $VSe_{1\cdot97}$ have been obtained, and their crystal structures and magnetic properties studied. They are stable in air, and resistant to acids except to HNO_3, which attacks them violently. In vac. at 1000° they lose Se until the composition VSe is attained. There are three phases : preps. from VSe to $VSe_{1\cdot13}$ belong to the α-phase, of NiAs type; those from $VSe_{1\cdot25}$ to $VSe_{1\cdot60}$ to the β-phase, which has a related but less symmetrical structure; and those from $VSe_{1\cdot62}$ to $VSe_{1\cdot97}$ to the γ-phase, of CdI_2 type. The lattice consts. range from a 3·58, c 5·98 A. for $VSe_{1\cdot04}$ to a 3·35, c 6·12 A. for $VSe_{1\cdot97}$. The transition from the NiAs to the CdI_2 structure, usually through an intermediate structure of lower symmetry, is of general occurrence among analogous compounds, and can be interpreted by reference to structure diagrams. The NaAs structure can be derived from the CdI_2 structure by insertion of an additional plane of metallic ions; when this process has not gone too far the structure is still essentially a CdI_2 structure, then, at a certain stage of completion of the additional plane, a structure of lower symmetry results, and finally the NiAs structure is obtained as the additional plane approaches completion. This view is supported by consideration of the course of the lattice consts., and of the vals. for ρ_4^{25} which ranges from 5·94 for $VSe_{1\cdot04}$ to 5·79 for $VSe_{1\cdot97}$. The mol. vols. correspond with at. binding. The preps. are all paramagnetic; ferromagnetism does not occur, and χ has a sharp max. at the composition V_2Se_3 but is always $\leqslant$ the theory for ionic binding. Attempts to prepare *V tellurides* by analogous methods gave impure products having V : Te $\sim 1 : 1$, resembling the selenides in appearance and properties, but having the Te rather loosely bound. The findings of Biltz and Köcher (A., 1939, I, 427) for the lower V sulphides are confirmed, apart from minor divergences in the vals. for ρ and the lattice consts. The phase relationships are analogous to those for the selenides.   F. J. G.

Preparation of pure gases and of pentane for cryostats. N. S. RUDENKO (J. Phys. Chem. Russ.,

1938, **12**, 668—676).—The prep. of pure O_2 from $KMnO_4$, N_2 from NH_4NO_3, CO from $HCO_2H + H_2SO_4$, C_2H_4 from $C_2H_4Br_2 + Zn$, and of CH_4 from NaOAc and NaOH is described. C_5H_{12} can be purified by repeated freezing out.   J. J. B.

Reactions between solids. II. F. TARADOIRE (Bull. Soc. chim., 1939, [v], **6**, 1249—1252; cf. A., 1939, I, 381).—Attempts to inhibit the reactions between S and Ag, I and Hg, and S and Hg by the removal of H_2O have been unsuccessful (cf. A., 1931, 692).   J. W. S.

Action of sulphuryl chloride on metals. V. K. PERSCHKE and C. L. TZEITLIN (J. Appl. Chem. Russ., 1939, **12**, 182—187).—Anhyd. SO_2Cl_2 strongly corrodes Cu and brass, and slightly corrodes Cr steel, Fe, cast Fe, Pb, Zn, and Al- and Ni-bronze; it has no action on Al, Mg, and Ni. In presence of H_2O Pb is only slightly corroded by SO_2Cl_2, and Zn, Al, and Fe alloys considerably so.   R. T.

Hydrates of neutral sodium tellurate. F. FOUASSON (Compt. rend., 1939, **208**, 2077—2080; cf. A., 1918, ii, 194).—Conductometric titration of telluric acid with NaOH and analysis of the pptd. tellurates shows that the initial pptd. product is $Na_2TeO_4,4H_2O$ (I), which is stable in presence of acid, but is converted into $Na_2H_4TeO_6$ by excess of NaOH. (I) is a metatellurate, metatelluric acid being unstable in alkaline solution (cf. A., 1936, 810).   A. J. E. W.

Potentiometric control of conversion of chromates into dichromates. L. E. SABININA and A. K. MORALEV (J. Appl. Chem. Russ., 1939, **12**, 301—308).—The p_H of 0·07M-$K_2Cr_2O_7$ is 4·18 (glass electrode). Conversion of K_2CrO_4 into $K_2Cr_2O_7$ (by addition of H_2SO_4) has been followed potentiometrically (indicator electrode Pb–PbO_2 in aq. $K_2Cr_2O_7$ at p_H 4·18, against a similar electrode in the test solution).   R. T.

Production of molybdenum. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], **6**, 1236—1238).—MoO_3 is heated with H_2S or S to yield MoS_2, which is mixed with Ca and heated slowly in a vac. or in an inert atm. until reaction occurs. After cooling, the product is washed with EtOH and with H_2O (acidified if necessary with HCl) to remove CaS and the excess of Ca. The fine insol. residue contains $>99\cdot6\%$ of Mo. The same method can be used for the prep. of pure Cr, W, and V.   J. W. S.

Ammonio-mannito-dimolybdic complexes. Determination of the constitution of the complex ion by conductometric titration. (MME.) Z. SOUBAREW-CHÂTELAIN (Compt. rend., 1939, **208**, 1652—1654).—The complex formed from equimol. proportions of $NH_4HMo_2O_7$ and mannitol (I) in aq. solution has the constitution $H[HMo_2O_7,NH_3,(I)]$ (II), and gives the same X-ray diagram as Tanret's salt (A., 1921, i, 544). Conductometric titration shows that addition of 1 mol. of NaOH to (II) gives the strongly-hydrolysed Na salt, which is slowly decomposed by further quantities of NaOH into (I), Na_2MoO_4, and $NaNH_4MoO_4$; the latter gives Na_2MoO_4 and NH_3 with excess of NaOH. Neutralis-

ation of (II) with aq. NH_3 yields the NH_4 salt, which undergoes similar changes on addition of NaOH.

A. J. E. W.

Preparation and identification of three alkali molybdotellurates. S. R. WOOD and A. CARLSON (J. Amer. Chem. Soc., 1939, **61**, 1810—1812).—The crystals obtained by evaporating a solution containing $0.06M$-MOH (M = Na, Rb, Cs), $0.01M$-telluric acid, and $0.06M$-MoO_3 are colourless, hexagonal rhombohedra and are highly efflorescent. They correspond with the general formula $3MO_2,TeO_3,6MoO_3,nH_2O$ (n for Cs = 7, for Rb = 6, for Na = 22).   W. R. A.

Xanthates of metals of group VI.—See A., 1939, II, 404.

Precipitation and other reactions in liquid hydrogen fluoride. H. FREDENHAGEN (Z. anorg. Chem., 1939, **242**, 23—32; cf. A., 1930, 421).—Certain anions besides F' can exist in liquid HF, and pptn. reactions can therefore be observed. HCl, HBr, and HI have only a very slight solubility in liquid HF, but the presence of a low concn. of their ions can be shown by bubbling them through liquid HF containing $Ag^{\cdot}$, when Ag halide is slowly pptd. By treatment of chlorides at $-10°$ with liquid HF, supersaturated solutions of HCl are obtained; these persist for some time, and give instantaneous pptn. with $Ag^{\cdot}$. Alkali and alkaline-earth perchlorates are sol. in HF, and from the solutions $AgTlO_4$ and $TlClO_4$ can be pptd. Vals. of Λ and of the b.p. elevation for solutions of $KClO_4$ in HF are in accordance with simple ionic dissociation. The solubility is 9.6 g. per 100 g. of solution. Solutions of H_2SO_4 or Na_2SO_4 in liquid HF contain a small equilibrium concn. of SO_4'', and excess of $Ag^{\cdot}$ ppts. Ag_2SO_4. Chlorates, bromates, iodates, permanganates, chromates, BaO_2, nitrites, and carbonates are all decomposed by liquid HF; persulphates dissolve quietly, but addition of $TlNO_3$ or KNO_3 causes decomp. with evolution of O_2, whilst with $AgNO_3$ a ppt. of Ag_2SO_4 is also formed.

F. J. G.

Action of fuming nitric acid on iodine. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 247—248).—When fuming HNO_3 reacts with I, I_2O_4 is first formed and is converted into I_2O_5 by H_2O. In the complete absence of H_2O, I_2O_4 is obtained by removal of N oxides from the pptd. I_2O_5.

W. R. A.

Molecular compound of ferric chloride extracted by ether from hydrochloric acid solution. S. KATO and R. ISHII (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 82—96).—$FeCl_3$ can be extracted by Et_2O from a solution in $7N$-HCl but not from solutions in $4N$- and $10N$-HCl. Absorption spectra of the Et_2O solution and of HCl solutions of various N. between 1 and 12 have been investigated. In $12N$-HCl the spectrum of $FeCl_3$ is very similar to that in Et_2O. Spectroscopic evidence indicates that a mol. compound, $FeCl_3,HCl,3H_2O$, is present in the Et_2O solution. By chemical methods, gradual decrease in wt. of Et_2O extract by slow evaporation, and investigation of the composition of residual solutions at various stages of evaporation, the formula, $2FeCl_3,2HCl,9H_2O,15Et_2O$, is derived for the compound.   W. R. A.

cis-trans-**Isomerism in octahedral groups.** H. M. POWELL (J.C.S., 1939, 1106—1108).—Theoretical. The proportion in which *cis*- and *trans*-isomeric groups of formulæ MA_2B_4, MA_3B_3, and MA_4B_2 may, with certain restrictions as to the nature of A and B, be expected to form in the same reaction from MA_6, MA_5B, *cis*- and *trans*-MA_4B_2, and *cis*- and *trans*-MA_3B_3 are discussed on a geometrical basis. Data for alkylated ferro- and cobalti-cyanides are in general agreement with the hypothesis.

C. R. H.

Quantitative spectrochemical analysis of mixtures of gases. R. A. WOLFE and O. S. DUFFENDACK (Proc. Sixth Conf. Spectros., 1938, 66—70).—Difficulties encountered in the quant. spectrochemical analysis of mixtures of gases, and methods of overcoming them, are discussed. The effect of clean-up of gases in discharge tubes is described. It varies with the type of discharge and the electrode voltage. The best type of discharge is a glow or electrodeless discharge. Intensities of lines of some elements vary with the amounts of other gases present. This difficulty is particularly marked where an inert gas is present. Interferences of this type can be overcome by using He in excess as the carrier of the discharge, and by the use of a small addition of A as the internal control. The technique of the method, which has been used to determine H_2, O_2, N_2, CO, and CO_2, is described.   A. J. M.

Influence of impurities on line strength in quantitative analysis. W. R. BRODE and R. W. SILVERTHORN (Proc. Sixth Conf. Spectros., 1938, 60—65).—A review of the literature concerning the effect of impurities on line intensities shows considerable discrepancies in the magnitude of the effect. The line intensities in the case of mixtures of Cd and Zn were determined, using the homologous pairs of 3252.5 A. (Cd) and 3345.0 A. (Zn), with Na, K, Pb, Mg, Cu, and Bi as impurities. In the concn. used only Cu and Bi had an appreciable effect on the relative intensity of the Cd–Zn lines, their effects being in opposite directions. The effect of impurities on line intensities seems to be limited to certain concn. ranges, and may be either positive or negative. For complete quant. analysis working curves should be prepared with various quantities of the impurities.

A. J. M.

Applications of the spectrograph to criminal investigation. C. W. RANKIN (Proc. Sixth Conf. Spectros., 1938, 6—9).—Examples of the use of the spectrograph in criminal investigation are given, and experiments to determine the elements present on cloth through which a bullet has been fired, and the variation of their line density with distance, are described. Although it is possible to trace the elements present in the bullet and powder, it is not possible to deduce from the spectrogram the distance from which the shot was fired. The use of the spectrograph in the detection of sulphhæmoglobinæmia is also described.   A. J. M.

Spectrograph as an aid in criminal investigation. J. T. WALKER (Proc. Sixth Conf. Spectros., 1938, 1—5).—Examples of the use of the spectrograph in criminal investigation are given. In particu-

lar its use in the identification of paints and poisons is dealt with, and experiments on tho spectrographic identification of elements in bullet-holes in cloth are described.   A. J. M.

Identifying minerals with the aid of the spectrograph. G. I. LEE and T. A. WRIGHT (Proc. Sixth Conf. Spectros., 1938, 38—45).—Putnam's chart of minerals is discussed, and a modification of it embodying results of spectrographic observations is put forward. The purity of minerals is discussed, and tho use of the spectrograph in determinative mineralogy is described. The use of the instrument in the discovery of new sources of minerals is also considered.   A. J. M.

Analysis of materials by fluorescent methods. W. E. ALBERTSON (Proc. Sixth Conf. Spectros., 1938, 48—50).—Examples of the application of fluorescence analysis are given.   A. J. M.

p-**Nitrophenylacetonitrile as an indicator.** L. SPITZER (Annali Chim. Appl., 1939, 29, 219—220).— In dil. aq. solution, a yellow to orange-red colour change occurs at p_H 11·4—12·9.   F. O. H.

Report of the American Oil Chemists' Society Committee on Indicators (Oil & Soap, 1939, 16, 132; cf. A., 1939, I, 533).—A 0·025% solution (0·1% for very dark oils) of Grubler's alcohol-sol. aniline-blue (cf. A., 1938, I, 533) in $Pr^{\beta}OH$ is recommended as an alternative indicator solution for the determination of free fatty acid in all crude cottonseed oils, the addition of 10 c.c. of light petroleum to the oil sample as and where stipulated in the standard methods being retained. The indicator solution requires very little base for neutralisation, is very little affected by atm. CO_2, and gives a clear, sharp end-point. $Pr^{\beta}OH$ does not appear to hydrolyse highly acid oils and is recommended as a substitute for the " Formula-30 " alcohol specified in the standard methods.   E. L.

Control of p_H in peroxide solutions. J. S. REICHERT and H. G. HULL (Ind. Eng. Chem. [Anal.], 1939, 11, 311—314).—The glass electrode is suitable for the determination of the p_H of peroxide solutions, but corrections are necessary in solutions of high p_H and high [$Na^{\cdot}$]. A comparison of colorimetric and potentiometric p_H methods for H_2O_2 solutions of 0—200 " vols." is given. Data showing the relationship between p_H and normality for these solutions are also recorded. In H_2O_2 solutions containing H_2SO_4 the $H^{\cdot}$ activity increases with the [H_2O_2].

    L. S. T.

Volumetric microchemistry. I. Neutralisations and acidimetry. O. ISHIZAKA (J. Pharm. Soc. Japan., 1939, 59, 16—17).—A mathematical treatment of the errors involved by the direct use of the factors of solutions of alkali hydroxide.   H. W.

Determination of hydrogen in gases.—See B., 1939, 797.

Determination of hydrogen peroxide and persulphate in the same solution. J. H. VAN DER MEULEN (Rec. trav. chim., 1939, 58, 553—558).— The S_2O_8'' is determined by means of $FeSO_4$ and $KMnO_4$ after destruction of the H_2O_2 with a trace of OsO_4, and the total concn. of oxidising agents determined in another portion.   F. J. G.

Colour tests for chlorine, ozone, and hypochlorites with methane base. A. T. MASTERMAN (Analyst, 1939, 64, 492—499).—Addition of O_3 to aq. " methane base " [$CH_2(C_6H_4\cdot NMe_2\text{-}p)_2$] (I) gives a sequence of characteristic colours : violet, amethyst, rose, and ruby-red; that of Cl_2 : blue, grassgreen, olive-green, orange, and yellow with final complete bleaching. Aq. OCl' gives the Cl_2 sequence. By concentrating (I) in EtOH solution, however, the O_3 sequence may be obtained. Hypochlorites prepared electrolytically give reactions which suggest that O_3 is also present.   E. C. S.

Volumetric oxidation of iodide to iodate by sodium chlorite. L. F. YNTEMA and T. FLEMING (Ind. Eng. Chem. [Anal.], 1939, 11, 375—377).— Aq. $NaClO_2$ can be used for the volumetric determination of I' in solutions buffered to p_H 5·3—5·7 with acetates or phosphates, but less satisfactorily so with Zn salts. The reaction involved is $3HClO_2 + 2I' = 2IO_3' + 3Cl' + 3H^{\cdot}$. NO_3' and SO_4'' do not interfere, but Cl' retards the reaction and Br' must be absent. 0·04—0·07 g. of iodide is dissolved in cold air-free H_2O. 1 ml. of 2M-AcOH, 9 ml. of 2M-NaOAc, and starch solution are added, and the whole is titrated with 0·1— 0·2N-$NaClO_2$ until discharge of the blue colour indicates conversion of I' into IO_3'. A slight excess of chlorite is added and back-titrated with 0·02M-KI to a permanent amber colour.   L. S. T.

Colorimetric determination of fluorine with ferron. J. J. FAHEY (Ind. Eng. Chem. [Anal.], 1939, 11, 362—363).—The yellowish hue produced by the action of F' in the unknown solution on the green colour of the ferron–Fe reagent (0·1N-$FeCl_3$ in 2N-HCl + aq. 7-iodo-8-hydroxyquinoline-5-sulphonic acid) is matched in a comparison solution by addition of a standard solution of NaF. Details for the determination of F in rocks, which are fused with Na_2CO_3 and treated with $ZnCl_2$ and ZnO + $(NH_4)_2CO_3$ + aq. NH_3, are given, and test data on synthetic samples are recorded. A difference in colour corresponding with a difference in [F'] of 0·05 mg. is detectable with rocks, and one of 0·025 mg. with natural waters. The method is applicable to rocks and minerals containing $\not> 10\%$ of F, and to waters containing $\not< 1$ p.p.m. Results obtained on waters by this method are compared with those given by the ferrithiocyanate method (A., 1933, 41, 921).   L. S. T.

Determination of dissolved oxygen in aqueous solutions.—See B., 1939, 788.

Determination of organic sulphur in gas mixtures.—See B., 1939, 797.

Potentiometric determination of selenious acid with silver ion. R. RIPAN-TILICI (Z. anal. Chem., 1939, 116, 431—433).—The solution containing SeO_3'' is neutralised (p_H 8—9) with 0·05M-$NaHCO_3$ and titrated potentiometrically with 0·1 or 0·05M-$AgNO_3$, with vigorous stirring. The method is preferred to that described previously (A., 1939, I, 96). Data for the titration of 0·001—0·0025M-Na_2SeO_3 are recorded.   L. S. T.

Selenium catalyst in the Kjeldahl digestion of leather.—See B., 1939, 867.

Rapid method of determining [protein-]nitrogen.—See B., 1939, 877.

Determination of nitrogen oxides in [coal] gas.—See B., 1939, 797.

Spectrographic determination of arsenic in copper.—See B., 1939, 840.

Colorimetric micro-determination of boron. J. A. NAFTEL (Ind. Eng. Chem. [Anal.], 1939, 11, 407—409).—An aliquot portion of soil or plant ash extract containing 0·5—8·0 μg. of B is made alkaline with 0·1N-Ca(OH)$_2$, evaporated to dryness, and then cooled to room temp. A solution of H$_2$C$_2$O$_4$ + HCl is added, followed by either curcumin or turmeric in 95% EtOH. The mixture is evaporated to dryness at 55±3° and heated at this temp. for 30 min., in order to complete the colour reaction between the H$_3$BO$_3$ and curcumin or turmeric. The residue is extracted with 95% EtOH, filtered or centrifuged, and compared with standard solutions treated similarly. Interference from other ions normally present in soil extracts is negligible. The comparison is best effected in a photo-electric colorimeter. Kavalier Bohemian glass is a satisfactory B-free glass. Test data showing the effects of variations in conditions on the intensity of the developed colour are recorded. L. S. T.

Photometric method for the determination of carbon dioxide. R. J. WINZLER and J. P. BAUMBERGER (Ind. Eng. Chem. [Anal.], 1939, 11, 371—375).—[CO$_2$] is measured continuously by determining the changes in light transmission of a solution of Me-red through which the gas is passed. A method of making gas mixtures of known composition is described. A method of calculating the reliability of photometric measurements is developed and applied to the case of CO$_2$. L. S. T.

Warder's method for the titration of carbonates. A. A. BENEDETTI-PICHLER, M. CEFOLA, and B. WALDMAN (Ind. Eng. Chem. [Anal.], 1939, 11, 327—332).—A crit. survey of the method shows that titration of CO$_3$'' to HCO$_3$' must be carried out in a closed system to avoid loss or gain of CO$_2$. A procedure of suitable accuracy has been tested on a CO$_3$''–HCO$_3$' solution. In the application of Warder's method to the determination of OH', CO$_3$'', and HCO$_3$' in presence of each other the precision becomes poor when the mass of the constituent determined is <0·1 of the mass of the major component. The method is inapplicable to the determination of traces of hydroxide in carbonate, of traces of carbonate in H carbonate, and vice versa. L. S. T.

Gas-volume determination of carbonate in calcareous materials.—See B., 1939, 823.

[Alkalis in] silicate analysis. BÜTTNER (Keram. Runds., 1939, 47, 101—102).—The Lawrence Smith method and its modifications (e.g., use of CaCl$_2$ in place of NH$_4$Cl) are excellent when correctly carried out, but care must be taken to avoid volatilising the alkali chlorides by overheating. Use of Ba compounds in place of Ca did not lower the reaction temp.

sufficiently to overcome this. If the material is too coarse or is insufficiently strongly heated, attack is incomplete. This method is preferable in the presence of MgO, B$_2$O$_3$, and P$_2$O$_5$, but otherwise the Berzelius (HF) method is safer and quicker. G. H. C.

Use of flame in spectrum analysis. S. L. MANDELSTAM (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 403—406).—Calculations of the effect of relatively large amounts of Na salts and KCl on the intensity of the Rb lines given by 0·001% aq. RbCl (A., 1939, I, 227) are recorded and discussed. L. S. T.

Identification of silver. F. A. VAN ATTA (J. Chem. Educ., 1939, 16, 164).—Reduction to Ag of the ammoniacal solution of AgCl by means of CH$_2$O in presence of KOH is preferred to acidification by HNO$_3$ in which re-pptn. of AgCl is erratic. In the absence of large amounts of Hg˙, Ag˙ can be detected at a concn. of 0·5 mg. per l. L. S. T.

Qualitative mineral analysis. G. EMSCHWILLER and G. CHARLOT (Ann. Chim. Analyt., 1939, [iii], 21, 176—180).—A method of qual. analysis which combines the classical method of separating metals into groups with sp. tests, particularly with org. reagents, is suggested. J. W. S.

Quantitative precipitations at extreme concentrations. VI. V. NJEGOVAN and V. MARJANOVIĆ (Z. anal. Chem., 1939, 117, 109—118; cf. A., 1937, I, 147; 1933, 921).—Numerous data showing the purity of the BaSO$_4$ pptd. by the method described previously (A., 1928, 497) under different conditions are recorded. The BaSO$_4$ contains ≯1% BaCl$_2$ and, when pptd. in presence of Fe˙˙˙, ≯ traces of Fe$_2$O$_3$. The method is also applicable in presence of NH$_4$ salts. Filtration is improved by the use of paper pulp. The results also refute the criticisms of Balarev (A., 1939, I, 72). L. S. T.

Reaction of zinc with copper sulphate in aqueous solution. F. W. VAN STRATEN and W. F. EHRET (J. Amer. Chem. Soc., 1939, 61, 1798—1804). Zn strips, 0·3 mm. thick, were annealed at 200°, coated on one side with varnish, and etched. Four strips were suspended in 1 l. of CuSO$_4$ solution, thermostatically controlled, on a glass cage attached to the rotor of the stirring apparatus and the effective area of exposed surface was 12 sq. cm. per strip. The deposits formed under a variety of experimental conditions were examined by chemical and X-ray methods. Increased [CuSO$_4$] gave a Cu-enriched deposit whilst addition of ZnSO$_4$ to the CuSO$_4$ solution diminished the amount of Cu in the deposit. The greater is the speed of stirring, the greater is the amount of Cu deposited, indicating that rates of displacement are governed by diffusion. Variation in p_H has a negligible effect. Secondary reactions between the deposit and CuSO$_4$ solution have been investigated. X-Ray evidence indicates that Cu is the principal phase at 25° with some α-brass. At higher temp. and at low [CuSO$_4$] the amounts of α- and β-brass increase. W. R. A.

Determination of zinc as zinc mercury thiocyanate. I. SARUDI (v. STETINA) (Österr. Chem.-Ztg., 1939, 42, 297—298).—50 c.c. of solution con-

taining ~0·1 g. of Zn are acidified with 1—2 c.c. of N-HNO_3 and 40 c.c. of reagent (27 g. of $HgCl_2$ and 39 g. of KCNS per l.) added with continual stirring. After 30 min., the $ZnHg(CNS)_4$ is collected (Jena 1G4), washed with H_2O, EtOH, and finally anhyd. Et_2O, and dried for 90 min. at 100°. Small amounts of Zn (0·01—0·005 g.) can be determined by using reduced vols. The method tends to give results which are slightly low, but can be improved by adding to the solution one third of its vol. of 96% EtOH after pptn. has been effected and washing with dil. (1 : 2) EtOH instead of H_2O. Test data are recorded.   L. S. T.

Determination of cadmium in silicate rocks. E. B. SANDELL (Ind. Eng. Chem. [Anal.], 1939, 11, 364—365).—The rock powder is attacked by means of $HClO_4$ + HF, and the heavy metals are extracted by shaking the ammoniacal citrate solution of the decomposed rock with dithizone (I) in CCl_4. The CCl_4 phase is separated and shaken with 0·01N-HCl, when the Zn, Pb, and Cd dithizonates are decomposed and the metals go into the aq. phase as chlorides. Cd is then determined in 5% NaOH solution by means of (I) in CCl_4 (A., 1937, I, 632). Details of procedure and test data are given. With a 0·5-g. sample, 0·02—0·03 μg. of Cd can be detected. Results tend to be low. Cu, Zn, Pb, and Co in the amounts likely to occur in igneous rocks do not interfere, but large amounts of Ni render the method inapplicable. Mn tends to prevent complete extraction of Cd, but this can be overcome by adding NH_2OH,HCl.
                                                                    L. S. T.

Determination of lead by dithizone. Modifications and improvements of the Hubbard–Clifford–Wichmann method as applied to biological material. K. BAMBACH (Ind. Eng. Chem. [Anal.], 1939, 11, 400—403; cf. A., 1936, 443).—Slight changes in apparatus and in manipulation of Hubbard's method (A., 1937, III, 504) result in a saving of time and an increased recovery of Pb. The use of NH_2OH in the initial extraction prevents oxidation of the dithizone (I), and eliminates the necessity of the second extraction step of the Hubbard method. Washing the first $CHCl_3$ extract removes extraneous entrained salts, and improves the test for Bi. Elimination of filtrations through cotton and paper, and addition of the standard (I) and the development of the mixed colour in all samples of a series before the photometric readings are made, save time without loss of accuracy. Details of procedure and a comparison of results obtained by the old and the new methods are given. Methods for the prep. of Pb-free solutions of NH_4 citrate, KCN, and NH_2OH,HCl are described. By purification of reagents and elimination of contamination the " blank " has been reduced to 0·1 μg.   L. S. T.

Determination of lead in steels.—See B., 1939, 838.

Electro-analytical determination of copper and lead in nitric acid solution containing small amounts of hydrochloric acid. J. A. SCHERRER, R. K. BELL, and W. D. MOGERMAN (J. Res. Nat. Bur. Stand., 1939, 22, 697—700).—Complete cathodic deposition of Cu from HNO_3 solution is obtained if a trace of Cl' is added either during dissolution of the alloy or before electrolysis. The sample (1 g.) is treated with 50% HNO_3 (25 c.c.) and 0·1N-HCl (1 drop). When action has ceased the solution is boiled until all N oxides are expelled and is then diluted to ~150 c.c. If Sn is present the solution is digested for ≮ 1 hr. and the ppt. is separated and washed with hot dil. HNO_3. The filtrate is neutralised with aq. NH_3, 6 c.c. of HNO_3 are added, and the solution is diluted to 200 c.c. Cu and Pb are deposited on cylindrical Pt gauze electrodes with a current of 0·2—0·4 amp.
                                                                    J. W. S.

Rapid electro-analysis of copper. M. GELOSO (Bull. Soc. chim., 1939, [v], 6, 1238—1243).—The action of Fe^{III} in causing redissolution of Cu deposited electrolytically (A., 1939, I, 424) can be prevented by addition of a fluoride, which converts it into $[FeF_6]'''$. For determination of Cu in the presence of Fe the sample, containing ⯮ 0·5 g. of Fe, is dissolved in conc. H_2SO_4 (5—10 c.c.) and HNO_3 (d 1·33, 2—3 c.c.). The solution is diluted to 200 c.c., 25 g. of NH_4OAc are added, and 10% aq. KF or saturated aq. NaF is run in until only the colour due to Cu remains. The solution is then electrolysed at 60—80° with agitation for ½ hr., using a current ⯮ 1 amp.
                                                                    J. W. S.

Determination of copper by Schachkeldjan's method with the help of Lange's photo-electric colorimeter. W. MAIER (Z. anal. Chem., 1939, 116, 410—421).—Sources of error in this determination by Schachkeldjan's method (A., 1930, 444) have been investigated. The colour intensity and colour tone change quickly after addition of the KCN, but the time interval between the addition of the benzidine and the KCN is without effect on the extinction. The age of the Na salicylate solution also affects the colour in certain cases, but not invariably. The [KCN] of solutions for comparison must be the same. In the procedure described, the extinction must be determined immediately after the addition of the KCN. The method gives an accuracy of 0·2—0·3% with 0·002 —10 mg. of Cu in 20 c.c. of solution.   L. S. T.

Simple micro-test for copper. E. HEYMAN and L. F. KERLEY (Analyst, 1939, 64, 502—503).— 0·5—1 p.p.m. of Cu can be detected by the formation of a blue-green colour when 100 c.c. of the solution are treated with a drop (0·05 ml.) of oleic acid. The p_H should be between 5 and 8. Co, Ni, and Cr do not interfere, and Mn and Fe only when present in quantity.   E. C. S.

Sulphamic acid in the separation of the rare earths. J. KLEINBERG, W. A. TAEBEL, and L. F. AUDRIETH (Ind. Eng. Chem. [Anal.], 1939, 11, 368— 369).—Ce-free rare earth oxides are dissolved in a slight excess of $NH_2·SO_3H$, and the cooled, filtered solution is treated with solid $NaNO_2$, which ppts. the La sub-group as sulphates. The Y sub-group is then pptd. as oxalates. The method compares favourably with the classical alkali double sulphate procedure, over which it has certain advantages. The sulphamates of La, Nd, Sm, and Y have been prepared. They are insol. in abs. EtOH, MeOH, $COMe_2$, dioxan, C_5H_5N, and liquid NH_3. They decompose slowly at 100° into the corresponding sulphates, and undergo slow hydrolysis in hot, aq. solution.   L. S. T.

Acidimetric determination of aluminium. K. KOMÁREK (Coll. Czech. Chem. Comm., 1939, **11**, 189—195).—Freshly pptd. $Al(OH)_3$ is titrated with $0.1N$-HCl using bromophenol-blue as indicator. The method is applicable to 0.0001—0.04 g. of Al. With the max. amount of Al allowed, the final vol. of the solution should be ~ 80 ml. and the titration should take ~ 30 min. C. R. H.

Quantitative spectral analysis of aluminium and aluminium alloys.—See B., 1939, 844.

Separation of cobalt from manganese. J. G. FAIRCHILD (Ind. Eng. Chem. [Anal.], 1939, **11**, 326—327).—Mn can be separated almost completely from Co by pptn. as phosphate by adding aq. NH_3 slowly to a hot solution containing 2 g. of citric acid, 1—2 g. of $(NH_4)_2HPO_4$, 20 g. of NH_4Cl, and $\not> 0.1$ g. of Mn per 100 ml. Other members of the $(NH_4)_2S$ group and $>$ a few mg. of the alkaline earths, and Mg, should be absent. The Mn is determined finally by the bismuthate method. Co retained by the Mn is determined colorimetrically as the blue $CoCl_2$. The presence of >1 mg. of Co imparts a lilac colour to the pptd. Mn phosphate. The main portion of Co is pptd. as sulphide at p_H 5.2 in dil. AcOH solution, converted into $CoSO_4$, and weighed as anhyd. sulphate after ignition at 550—600°. Up to 0.444 g. of $CoSO_4$ can be accurately determined as the anhyd. salt. The procedure is especially suitable for the analysis of Co-bearing psilomelane. L. S. T.

Polarographic studies with the dropping mercury electrode. X. Anodic oxidation of manganese tartrate and its analytical applications. E. T. VERDIER (Coll. Czech. Chem. Comm., 1939, **11**, 233—242).—The irreversible oxidation of Mn^{II} to Mn^{III} takes place in strongly alkaline solutions in presence of 5% of tartrate and in absence of O_2. The height of the polarographic waves varies quantitatively with the amount of Mn. Mn in Fe alloys can be determined polarographically by reducing a HCl solution of the alloy with Na_2SO_3 and adding KCN. The height of the waves due to electrodeposition of $Mn(CN)_2$ is a measure of the amount of Mn. Cr, Zn, and Cu do not interfere. In presence of Co, alkali and tartrate are added instead of KCN to the reduced alloy solution. Traces of Fe in Mn can be determined by making use of the anodic oxidation wave of Fe^{II} in alkaline tartrate solution, Mn not interfering provided it is present as Mn^{II}. C. R. H.

Standardisation of strong oxidising agents with potassium iodide by the acetone method. I. M. KOLTHOFF and H. A. LAITINEN (J. Amer. Chem. Soc., 1939, **61**, 1690—1691; cf. A., 1937, I, 260).—A simple procedure is described for the standardisation of $0.1N$-$KMnO_4$ and $0.1N$-$Ce(SO_4)_2$ by Berg's method using KI as the primary standard, which gives results 0.8—1% low when applied to $0.01N$. solutions. The low results are due to the reduction of the oxidising agent by $COMe_2$ and $COMe\cdot CH_2I$ near the end-point. W. R. A.

Tetraphenylarsonium chloride as an analytical reagent. Determination of rhenium. H. H. WILLARD and G. M. SMITH (Ind. Eng. Chem. [Anal.], 1939, **11**, 305—306).—ReO_4' forms with $AsPh_4^{•}$ a white, cryst. ppt. which is insol. in H_2O. ReO_4' can thus be determined potentiometrically, gravimetrically, or by titration of the excess of the reagent with I (cf. A., 1939, I, 336). In the gravimetric method, 0.40—133.0 mg. of ReO_4' in a vol. of 25—60 ml. can be satisfactorily determined by addition of a measured excess of $AsPh_4Cl$ to the hot solution in presence of NaCl ($0.5M.$) which facilitates the production of a cryst. ppt. that can be easily handled. Pptn. can be effected in weakly alkaline to acid solutions. NaOH exerts a solvent effect on the ppt., but relatively high $[NH_3]$ is not harmful. NO_3' in all but low concn. must be absent. MnO_4', ClO_4', IO_4', I', Br', F', CNS', $Hg^{••}$, $Sn^{••••}$, $VO_2^{••••}$, and $Bi^{•••}$ interfere. Interference by MoO_4'' can be avoided by the use of aq. NH_3, citrate, or tartrate. L. S. T.

Effect of foreign ions on double mercuric thiocyanate reactions. (Interference in microchemical reactions.) F. M. BOSCH (Natuurwetensch. Tijds., 1939, **21**, 117—121).—Fe^{III} gives a ppt. similar to that given by Cu, when treated with $Zn^{••}$ and $NH_4Hg(CNS)_4$. The Fe can be kept in solution by using $0.1N$-NaF solution, which retains 1.22 mg. Fe per c.c. $Fe(CNS)_3$ can also be removed by extraction with Et_2O. Na tartrate, Na citrate, and $K_2C_2O_4$ do not prevent pptn. of Fe. S. C.

Determination of iron in tungsten and tungstic acid.—See B., 1939, 842.

Determination of cobalt in steels.—See B. 1939, 838.

Determination of nickel and cobalt in silicate rocks. E. B. SANDELL and R. W. PERLICH (Ind. Eng. Chem. [Anal.], 1939, **11**, 309—311).—The method is based on the extraction of Ni dimethylglyoxime (I) with $CHCl_3$ from an ammoniacal citrate solution obtained after the rock sample (0.25—0.5 g.) has been attacked by means of $HClO_4$ and HF. By shaking the $CHCl_3$ extract with dil. HCl, (I) is decomposed, and the Ni is brought into the aq. phase, in which it is determined colorimetrically by Rollet's method (A., 1926, 930). The method will detect $<0.0001\%$ of Ni in 0.5 g. of rock, and is designed for rocks in which the Ni content is too low to be determined gravimetrically (A., 1934, 49). Cu, Co, Mn, Cr, and V in the amounts likely to be encountered in igneous rocks do not interfere. Co in rocks is determined by extraction of the heavy metal dithizonates with CCl_4 from an ammoniacal citrate solution of the sample (0.25—1 g.). The extract is evaporated to dryness, the residue ignited, and the oxides dissolved in HCl + HNO_3. Cu is reduced to $Cu^{•}$ by means of $SnCl_2$, and the Co determined colorimetrically by addition of NH_4CNS and $COMe_2$. Some Ni accompanies the Co, but its low concn. does not interfere even with a ratio Ni : Co of 10 : 1. The Co can also be determined by the NH_4CNS–$C_5H_{11}\cdot OH$ method in which large amounts of Ni do not interfere. With a 1-g. sample, 0.0001% can be detected. L. S. T.

Colorimetric determination of nickel as nickel–ammonia complex ion. G. H. AYRES and F. SMITH (Ind. Eng. Chem. [Anal.], 1939, **11**, 365—367).—A method for the colorimetric determination of Ni as its NH_3 complex is described. The blue

colour is stable over a period of 150 hr., and develops best in $1.5\text{N-}NH_3$. NH_4 salts up to 1.5 N., SO_4'', Cl', and NO_3' are without effect on the transmission. 0·5 mg. of Ni per l. can be detected, and the optimum region of sensitivity lies between 500 and 1500 mg. per l. In this range, the accuracy is 1%. Interference by Co is marked, and cannot be eliminated by the use of a light-filter. In steels, Ni is first separated as the dimethylglyoxime compound which is dissolved in HNO_3 and evaporated to a small vol. before dilution with $1.5\text{N-}NH_3$. This method for Ni in steels is less accurate than the gravimetric, but is quicker. L. S. T.

Rapid determination of chromium in leather etc.—See B., 1939, 867.

Volumetric determination of molybdenum.—See B., 1939, 843.

Analytical chemistry of tungsten. I. D. A. LAMBIE (Analyst, 1939, **64**, 481—490).—The recovery of H_2WO_4 from sulphate solutions containing alkali metal sulphate by pptn. with mineral acid or cinchonine is incomplete. Schoeller and Jahn's tannin-cinchonine method (A., 1927, 1047) is rapid and accurate. A modification of the method for determining larger amounts (>0·2 g.) of H_2WO_4 is described. E. C. S.

Precipitation of tin from alkaline solution with bromine water. T. KROKOWSKI (Z. anal. Chem., 1939, **117**, 105—109).—Sn is pptd. quantitatively as α-stannic acid (1) from an alkaline solution by the addition of aq. Br, preferably at a temp. >30°. The presence of NH_4NO_3 accelerates pptn. KOH is preferable to NaOH for the original dissolution of the Sn; a large excess should be avoided. Excess of Br should be removed, if desired, adding $(CH_2)_6N_4$ and heating to 60°. Although colloidal, the ppt. is easily filtered and washed (0·1% NH_4NO_3). Tartaric and citric acids inhibit pptn.; small, but not high, concns. of C_2O_4'' are without effect. Owing to adsorption by (I), the method cannot be used for separating Sb and Sn. L. S. T.

Volumetric determination of tin in ores.—See B., 1939, 841.

Spectrographic determination of vanadium in steel.—See B., 1939, 838.

Low-temperature precision adiabatic calorimeter adapted to condensed gases from 10° K. to room temperature. J. G. ASTON and M. L. EIDINOFF (J. Amer. Chem. Soc., 1939, **61**, 1533—1538).—A low-temp. adiabatic calorimeter for condensed gases (described) has an accuracy of 0·05% in sp. heat measurements up to room temp., and 0·1% in heat of vaporisation measurements at approx. room temp. The heat capacity of liquid NH_2Me has been determined over the entire range below room temp. W. R. A.

Reproducibility of the platinum thermocouple at the freezing points of gold, silver, and antimony. M. DE SELINCOURT (Proc. Physical Soc., 1939, **51**, 695—709).—The factors limiting the reproducibility of the standard Pt couple at the three points at which it is calibrated for the realisation of the international temp. scale for 660—1063° are considered with reference to electrical measurement, temp. conditions in the furnaces containing the ingots, and homogeneity of the thermocouple wires. The electrical measuring unit is found to be adequate for an accuracy of the order $\pm0.01°$, and improvements in the other two factors render such an increased accuracy just attainable as an upper limit. The quality of the thermocouple wires, particularly in relation to their state of strain, is the main obstacle to an increase in reproducibility beyond the normal limit of $\pm0.1°$. N. M. B.

Calorimetric measurements. Combustion of solids and liquids. T. J. KALIŃSKI and C. FIJAŁKOWSKI (Przemysł Chem., 1939, **23**, 147—152).—Powders are weighed and burned in collodion bags, non-volatile liquids in Pt dishes in similar bags, and volatile liquids in sealed thin glass ampoules similarly wrapped in collodion bags (the ampoules cave in at the pressure prevailing in the bomb after loading with O_2). R. T.

Mechanical thermo-regulator. A. C. BRATTON (Science, 1939, **89**, 589—590).—Three types of regulator, giving control to $\pm0.01°$, $\pm0.03°$, and $\pm0.003°$, in which a controlled stream of cooling H_2O (tap H_2O) is constantly introduced into the bath, are described and illustrated. L. S. T.

Experiments on pumping liquid helium to low temperatures. A. H. COOKE and R. A. HULL (Nature, 1939, **143**, 799—800).—Using a membrane pierced by a small hole to restrict the creeping of the He II film (cf. A., 1939, I, 220) temp. of ~0·73° K. have been obtained in a vessel of 4 c.c. capacity with an ordinary pump of 10 l. per sec. speed. L. S. T.

Cryoscopy. D. M. QUINTELA (Rev. Soc. Brasil. Quim., 1939, **8**, 35—39).—A review of methods employed in the cryoscopic determination of mol. wt. F. R. G.

Possible use of superconductivity for radiometric purposes. A. GOETZ (Physical Rev., 1939, [ii], **55**, 1270—1271).—The superconductivity of metal crystals near the lower end of the temp. scale appears to fulfil the conditions of a radiometer favourably owing to the practical non-existence of thermal indeterminacy, the sharp transition, and the nearly infinite temp. coeff. A sensitivity of 10^{-11}—10^{-12} g.-cal. per sec. is calc. N. M. B.

Radiation measurements on short [hertzian] waves. C. GUTTON and F. CARBENAY (Compt. rend., 1939, **208**, 1954—1957).—A hot wire and thermocouple are used to determine the induced current in a symmetrical frame, from which the intensity of the vertical component of the field is deduced. The apparatus is designed for $\lambda\lambda$ of 10—50 m. A. J. E. W.

Standard wave-lengths. W. F. MEGGERS (Proc. Sixth Conf. Spectros., 1938, 114—117).—A committee of the International Astronomical Union has made recommendations for a system of international standard $\lambda\lambda$ consisting of a primary standard (red radiation, 6438.4696 A., from Cd under certain conditions), secondary standards from the spectrum of the Fe arc, a table of which is given, tertiary or inter-

polated Fe standards, secondary standards from inert gas spectra (Ne and K, tables given), and solar spectrum standards.   A. J. M.

Characteristics of spectroscopic light sources. R. A. SAWYER and H. B. VINCENT (Proc. Sixth Conf. Spectros., 1938, 54—59).—The factors demanded in a light source for accuracy in spectrographic analysis are discussed. The use of the d.c. arc and methods of stabilising it are described. The a.c. arc and spark methods are also described. The technique of the internal standard method of analysis is considered.   A. J. M.

Characteristics of the Eagle mounting of the concave grating. G. H. DIEKE (Proc. Sixth Conf. Spectros., 1938, 71—79).—A comparison of the different grating mountings, including the Rowland, the Paschen, the Wadsworth, and the Eagle mounting, shows that for ordinary laboratory use the Eagle mounting is the most suitable. The astigmatism of the concave grating can be effectively removed in the Eagle mounting with the use of cylindrical lenses.   A. J. M.

Improved density comparator. J. W. FORREST (Proc. Sixth Conf. Spectros., 1938, 88—90).—An apparatus designed for continuous accurate performance is described.   A. J. M.

High-speed method of absorption spectrophotometry for the range 10,000 to 2000 A. G. R. HARRISON (Proc. Sixth Conf. Spectros., 1938, 91—96).—An automatic spectrophotometer consisting of the following four units is described : a concave grating monochromator which gives high intensity and spectral purity and almost const. high dispersion; photo-electric measurement of intensities by means of an electron multiplier with an amplification of 30,000,000, with sufficient output to operate a cathode-ray oscillograph through a supplementary logarithmic amplifier; a cathode-ray oscillograph and motion-picture film enabling density measurements to be made at the rate of 10 or more per sec.; an oscillating mirror to reflect a monochromatic beam through solution and blank cells up to 60 times a sec.   A. J. M.

Standard helium lamp for measuring intensities of spectral lines. O. S. DUFFENDACK and R. A. WOLFE (Proc. Sixth Conf. Spectros., 1938, 97—100).—A simple lamp containing He, of which the spectrum lines would have const. relative intensities over a long period, is described. The advantages of using a standard lamp are discussed. Variation of the voltage applied to the lamp did not alter the relative intensities of the lines emitted.   A. J. M.

Application of isodensity contouring methods to spectrum photometry. B. O'BRIEN (Proc. Sixth Conf. Spectros., 1938, 101—109).—The application of the wedge method of determining intensity of spectrum lines is considered, particularly as regards its accuracy. The precision of the method with high-contrast printing is equiv. to that of the more common method of measuring the density and calculating intensity from the characteristic curve, and it has the advantages of speed and convenience. The applica-

tion of the method to the automatic determination of O_3 in the zenith atm. is described.   A. J. M.

Testing dispersion filters. F. WEIGERT (Proc. Sixth Conf. Spectros., 1938, 110—111).—The use of dispersion filters (mixtures of a suitable coarse-grain powder, e.g., glass, and an org. liquid) as monochromators is described, and their advantages are discussed. A simple method of calibrating such filters is described.   A. J. M.

Standard slide for qualitative spectrochemical analysis. T. C. CHANG (J. Shanghai Sci. Inst., 1939, [i], **1**, 225—238).—A standard slide for qual. spectrographic analysis by the arc method has been prepared. The slide contains the persistent lines of all the elements which can be detected by the arc process.   A. J. M.

Diffraction of X-rays by a crystalline powder sprinkled on an immobile plane surface. F. D. LA TOUR (Compt. rend., 1939, **209**, 51—53).—A new method of X-ray diffraction by powders is described and its advantages and disadvantages are discussed. The theory of the method is outlined.   W. R. A.

Photo-electric photometer for colorimetric chemical analysis. M. ROSENFELD (J. Biol. Chem., 1939, **129**, 179—187).—An improved lay-out, applicable over a wide range of concns., is described.   R. S. C.

Application of fine-grain processing and condenser illumination enlarging to photomicrography. F. P. McWHORTER (Stain. Tech., 1939, **14**, 87—96).—Photomicrographs involving great resolution can be satisfactorily made by using an intermediate projection distance of about 160 mm. and recording the negative image in very fine grain. This eliminates vibration difficulties attending long exposure, and crit. enlarging at magnifications above ×2000 gives consistently good results.   E. E. H.

Technique in X-ray analysis of clays. J. C. L. FAVEJEE (Z. Krist., 1939, **100**, 425—436).—Difficulties peculiar to analysis of the fine-grained (<2 μ.) clay fractions are reviewed, and standard experimental and analytical methods detailed. Performance of a H_2-atm. powder camera is illustrated by X-radiograms. Relative intensities of lines obtained for α-quartz, muscovite (Ural), kaolinite (S. Carolina), and montmorillonite (Algeria : dried at 75% R.H.) are used in an approx. determination of their content in sea and river silts, loam, and fuller's earth.   I. McA.

Laue patterns by reflected X-rays. D. E. THOMAS (J. Sci. Instr., 1939, **16**, 222—228).—The X-rays are reflected from the surface of a metal ingot on to a film placed in a conical camera. A specially constructed circular slide rule is used in working out the crystal orientation.   D. F. R.

Ultramicroscope with large frontal distance for the study of aërosols. P. TAUZIN (Compt. rend., 1939, **209**, 27—30).—An ultramicroscope is described which can be modified to observe the motion of particles in the centre of an aërosol contained in cubic chambers of 4 cm. or 10 cm. side. The apparatus has been adapted to the measurement of the speed of

fall of the particles, the coagulation of aërosols, and the relation between the light diffused by the particles and their diameter, and the no. of particles per c.c.
W. R. A.

Antimony electrode for industrial hydrogen-ion measurements. G. A. PERLEY (Ind. Eng. Chem. [Anal.], 1939, **11**, 316—318).—The requirements of an industrial p_H electrode, the variable factors of a metal–metal oxide electrode, and the choice of such an electrode are discussed. The behaviour of Sb electrodes prepared in different ways from solid metal or from electroplated Sb on Pt or Au wires is described. A satisfactory form has been obtained by casting the electrolytically-deposited metal into a cylinder around which rubber is moulded. The exposed bottom of metal is ground and polished to a uniform smooth surface. Secondary reactions where the metal enters the solution are eliminated. Continuous measurements with an unprotected stick of Sb give erroneous results.   L. S. T.

Characteristics of the antimony electrode. G. A. PERLEY (Ind. Eng. Chem. [Anal.], 1939, **11**, 319—322).—The Sb electrode used is of the type described previously (cf. preceding abstract). The effects of the nature of the electrode surface, the concn. of dissolved air or O_2, agitation at the electrode surface, the nature and concn. of dissolved salts, and temp. on the e.m.f–p_H relationships of the electrode are detailed. With correct standardisation of these variables, continuous p_H measurements, reproducible to ± 0.15 p_H, can be obtained. The electrode gives satisfactory industrial performance in sugar- and paper-mill solutions, silicate solutions and clay suspensions, PO_4, aq. NH_3, and alum solutions, beer, lime treatment, etc.   L. S. T.

Determination of electrometric equivalence points. J. R. GAY (Ind. Eng. Chem. [Anal.], 1939, **11**, 383—386).—The apparatus described is simpler and less costly than that of the usual methods of potentiometric titration, and is equally sensitive. Its behaviour in the titration of $K_2Cr_2O_7$ with $FeSO_4$, of $FeSO_4$ with $KMnO_4$ or $Ce(SO_4)_4$, and of V^{IV} with $KMnO_4$ is described. The method is particularly serviceable in the determination of org. matter in sedimentary rocks by oxidation with H_2CrO_4 and back titration with Fe^{II}, where the use of $NHPh_2$ presents serious difficulties.   L. S. T.

Production of neutrons. C. WEISS and H. WESTMEYER (Physikal. Z., 1939, **40**, 461—466).—A simple apparatus for the production of neutrons making use of the reaction $^2_1D + ^2_1D \rightarrow ^3_2He + ^1_0n$ is described. It involves the use of a source of ions of high and const. intensity (described), and provides neutrons equiv. to 1 g. of Rn + Be.   A. J. M.

"Shadow"-microscope, a new electron-microscope. H. BOERSCH (Naturwiss., 1939, **27**, 418).—A new electron microscope, in which the image is the shadow of the object, is described. There is no optical system between the object and the screen.
A. J. M.
Performance of the electron shadow microscope, and an X-ray shadow microscope. M.

VON ARDENNE (Naturwiss., 1939, **27**, 485—486).—Under the same conditions the electron shadow microscope is as effective as the ordinary electron microscope as regards resolving power and intensity of image. An X-ray shadow microscope is described. Where refraction is necessary electron beams are used, but where rectilinear propagation is required X-rays are used. The resolving power of such an arrangement is independent of the thickness of the object.   A. J. M.

Electron tube direct-current voltmeter. R. L. GARMAN and M. E. DROZ (Ind. Eng. Chem. [Anal.], 1939, **11**, 398—399).—The use of 1·5-v. tubes with very low filament current permits the construction of an improved battery-operated voltmeter. Greater stability is obtained and operation is simplified by using a circuit which is new in principle. Operation as a titrimeter is also described.   L. S. T.

Cathode-ray tube alternating-current bridge detector for conductivity measurements. F. HOVORKA and E. E. MENDENHALL (J. Chem. Educ., 1939, **16**, 239—241).   L. S. T.

Method of comparing capacities at radio frequencies [and of determining dielectric constants]. W. VAUGHAN (Phil. Mag., 1938, [vii], **26**, 521—557).—The method described may be used to measure ϵ.

Determination of dipole moments in the vapour phase. I. An improved apparatus. L. G. GROVES (J.C.S., 1939, 1144—1147).—A heterodyne apparatus which employs stabilised matched oscillators of the Hartley type coupled electronically is described. The complete apparatus has a frequency variation of only about 3 cycles over periods of several hr., the natural frequencies of the oscillators being about 10^6 cycles. The gas cell is vapour-jacketed and the changes in capacity due to the introduction of dielectric gases or vapours are measured by direct parallel replacement on a special micrometer variable condenser. The beat frequency is observed as a simple Lissajous figure on a cathode-ray oscillograph using the mains frequency as a time base.   T. H. G.

Aperture error of electrostatic tube lenses. E. GUNDERT (Z. Physik, 1939, **112**, 689—690).—Apparatus for measuring this error is described and the dependence of the error const. on the ratio of the diameters of the two cylinders is calc. The error is least when both cylinders have the same diameter. Reduction of the diameter of either produces an increment in the error which is less for the case where the cylinder nearer the image is the smaller.
L. G. G.
Generalisation of coincidence devices. Anti-coincidences and their application to the study of cosmic rays. S. GORODETZKY (Compt. rend., 1939, **208**, 1987—1989).—Coincidence and anti-coincidence counters are connected to valves fed by a common anode resistance. The grid circuits are so arranged that the coincidence counter valves pass anode current with the counters at rest, and the anti-coincidence valves only when the counters function. Simultaneous impulses in both counter groups are thus not counted in the anode circuit, but impulses

given only by the coincidence group are recorded. The arrangement gives more accurate results, for a given time of measurement, than two separate sets of equiv. coincidence counts. A. J. E. W.

Photo-electric counters with a CuI photocathode, filled with ethyl alcohol vapour. D. ILKOVIC (J. Chim. phys., 1939, **36**, 140—146).—The theory of the photo-electric counter is given, and illustrated with reference to data obtained with a counter containing a CuI photocathode in an atm. of EtOH vapour. W. R. A.

Simple method for the control of counter-tube aggregates. C. B. MADSEN (Naturwiss., 1939, **27**, 453—454).—A special amplifying valve may take the place of a thread electrometer used in conjunction with a counter tube. The anode of the valve is connected with a small rod within the valve which acts as a fluorescence anode. A negative impulse on the grid of the valve causes an increase in the fluorescing area. The wire of the counter-tube is connected with the grid of the valve. A circuit is given. A. J. M.

Electro-capillary method [of analysis]. T. I. EFREMENKO (J. Appl. Chem. Russ., 1939, **12**, 297—300).—A Pt anode is placed at the centre of an annular Pt cathode on wet filter-paper, a drop of the solution under analysis is placed under the anode, drops of sp. cation reagents are placed at various points along the cathode, and a current is passed. The presence of cations is indicated by the appearance of coloured patches at various points between the electrodes. R. T.

Registration of coupled cosmic rays. W. KOLHÖRSTER (Physikal. Ž., 1939, **40**, 488—490).—An arrangement of counter-tubes involving triple coincidences is described, and results obtained with it are given. A. J. M.

Aperiodic balance. ANON. (J. Sci. Instr., 1939, **16**, 231).—The balance has a capacity of 200 g. and a sensitivity of 0·1 mg. It is air-damped, with an adjustment allowing free swinging if required. The beam can be released very slowly to minimise vibration and a new device ensures that eccentric loading of the pans will not cause them to swing. D. F. R.

Tantalum as a material for standards of mass. W. M. THORNTON, jun. (J. Chem. Educ., 1939, **16**, 157—160).—The results of independent calibrations of three 10-g. wts. of Ta show that when handled with ordinary care 10-g. wts. of this metal remain const. for >1 year. Difficulties in construction preclude the use of larger standards. L. S. T.

Modified burette for micro-analysis of gases. D. C. GRAHAME (Ind. Eng. Chem. [Anal.], 1939, **11**, 351).—A modification of the Blacet–Leighton gas micro-burette (A., 1931, 1027), in which the Hg threads are easily adjusted and do not drift from their set positions, is described. L. S. T.

Sterilisable filtration unit. F. A. HUDSON (Pharm. J., 1939, **143**, 50).—The unit consists of an all-glass Seitz filter fitted to a spherical receiver combined with an air filter and leading to a bell-cover and filling tube. The apparatus, which can be autoclaved assembled, is fitted with a rubber-tube safety valve for operation under gas pressure. F. O. H.

Capacity of fritted filters to withstand chemical attack in analytical work with alkaline liquids. P. H. PRAUSNITZ (Kolloid-Z., 1939, **88**, 96).—Error due to the loss of 2—3 mg. occurring during filtration of hot Fehling's solution can be avoided by subtracting the wt. of the filter determined after, instead of before, filtration (cf. Brintzinger, A., 1939, I, 161). F. L. U.

Improved mercury-sealed micro-absorption tube. R. J. ROBINSON and D. J. DOAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 406).—Alterations in the ordinary Pregl absorption tube so as to take a Hg seal at each end of the tube are described and illustrated. L. S. T.

Modified Schrötter apparatus. P. L. DE ARAUJO FEIO (Rev. Soc. Brasil. Quím., 1939, **8**, 43—46).—CO_3'' and OH' are determined in Schrötter's apparatus, having a graduated dropping funnel by means of which the total alkalinity in terms of H_2SO_4 is determined for the same sample as the CO_3''. F. R. G.

Bubbler tip of Pyrex glass for difficult absorptions. J. R. BRANHAM and E. O. SPERLING (J. Res. Nat. Bur. Stand., 1939, **22**, 701—705).—The tip is made by sealing a no. of Cu wires (diameter 0·1—0·2 mm.), arranged radially, between a cone formed on the end of a glass tube and a circular glass disc. After grinding the edge of the sealed joint to expose the ends of the wires the Cu is dissolved away in warm HNO_3. At moderate pressures these tips furnish small bubbles of uniform size and distribution. J. W. S.

Jones reductor. P. NILAKANTAM and N. JAYARAMAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 339).—The lower end of the reductor is bent upwards so that the H_2 which accumulates there may escape easily and not impede the flow of the solution. L. S. T.

Large-size extractor for liquids. F. W. SCHREIBER (Ind. Eng. Chem. [Anal.], 1939, **11**, 340).—An apparatus for the extraction of 40-l. batches of liquid by solvents lighter than H_2O, based on the lines of that described by Palkin et al. (A., 1925, ii, 708), is described and illustrated. Ergonovine at a concn. of 0·025% can be extracted completely by Et_2O in 10—12 hr. The Et_2O lost during an 8-hr. extraction is <500 c.c. L. S. T.

Preparation of grease-free polished surfaces. I. W. WARK (Nature, 1939, **143**, 1024).—Details for the prevention of contamination of polished surfaces of minerals and metals are given. A sensitive test for freedom from contamination is based on the zero angle of contact between an air bubble and a clean solid surface immersed in H_2O. The difficulty of avoiding contamination from the water supply is emphasised. L. S. T.

Needle valve for the micro-Dumas determination of nitrogen. E. B. HERSHBERG and L. SOUTHWORTH (Ind. Eng. Chem. [Anal.], 1939, **11**, 404—405).—The construction and use of a valve

to replace the stopcock between the combustion tube and the azotometer is described. The valve consists of a stainless steel needle which screws into Pyrex capillary tubing and is sealed by Hg.   L. S. T.

Continuous supply of hot distilled water. G. G. MARVIN (Ind. Eng. Chem. [Anal.], 1939, **11**, 399).—A 30-gall. gas-fired Whitehead automatic water heater containing a monel tank will supply 60—90 l. at 85° for 3 hr. The H_2O contained traces of Ni but no Cu.   L. S. T.

Improved three-way stopcock. M. A. SMITH and F. L. HAYES (Ind. Eng. Chem. [Anal.], 1939, **11**, 397).—In three-way stop-cocks with two stems on one side and one on the other, the risk of leakage is minimised by placing the two holes in the central tap at right angles to each other.   L. S. T.

Solenoid stirring device for use in confined spaces. H. H. BOWLEY and R. B. ANDERSON (Ind. Eng. Chem. [Anal.], 1939, **11**, 397).—A solenoid, controlled by a make-and-break device, is placed about the upper part of the cell or tube containing liquid, and raises the closed glass stirrer, the upper part of which encloses an Fe core.   L. S. T.

Meniscus reader. E. J. BOGAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 396).—The reader is modified so that it can be easily snapped on and off the burette, without moving the latter from its stand.   L. S. T.

Greaseless high-vacuum valve. R. H. CRIST and F. B. BROWN (Ind. Eng. Chem. [Anal.], 1939, **11**, 396).—The valve seat is made of Ag with AgCl as the seating surface and presses against the polished end of a Pyrex valve stem.   L. S. T.

Continuous extraction diffusion device. M. MEYER (Ind. Eng. Chem. [Anal.], 1939, **11**, 369).   L. S. T.

Measurement of surface tension by the static depolished plate method. M. ABRIBAT and A. DOGNON (Compt. rend., 1939, **208**, 1881—1882).—The pull on a plate partly immersed in the liquid is measured by applying an opposing force. Roughening of the plate, which is preferably of Pt, ensures perfect wetting.   A. J. E. W.

Apparatus for determining percentage composition. L. D. JOHNSON (J. Chem. Educ., 1939, **16**, 229—230).   L. S. T.

Rapid calculation of relative humidity from readings of the Sling hygrometer. A. J. TURNER (Nature, 1939, **143**, 897).—% R.H. = 100—300[(θ—θ′)/θ], where θ and θ′ are the dry- and wet-bulb temp. (°F.) of a ventilated hygrometer. The formula applies at R.H. >30% over an air-temp. range of 20—140° F.   L. S. T.

Mechanical device for smoothing data. T. SCHUMANN (Nature, 1939, **143**, 937—938).—The device described and illustrated eliminates the computations involved in obtaining a smooth curve from a series of observations.   L. S. T.

Apparatus for dispensing dry gaseous and liquid ammonia. C. H. ALMFELT and C. R. McCROSKY (J. Chem. Educ., 1939, **16**, 193—194).—Apparatus for condensing NH_3 from a cylinder on to dry NH_4CNS cooled by ice is described. Pure, dry liquid NH_3 can then be obtained by allowing the gas to condense in a vessel surrounded by $CO_2 + Et_2O$.   L. S. T.

Apparatus for the study of systems comprising one liquid and one solid phase. L. DOMANGE (Bull. Soc. chim., 1939, [v], **6**, 1255—1257).—A glass reservoir, fitted with a pipette which also acts as stirrer, is arranged in a centrifuge tube, the temp. of which is controlled thermostatically. When the mixture has attained equilibrium it is centrifuged, the liquid drawn into the pipette, and the moist solid left in the reservoir. Both the reservoir and pipette are provided with ground glass caps to facilitate rapid closure when the vessels are removed from the thermostat.   J. W. S.

Small hygrometer. D. E. HOWELL and R. CRAIG (Science, 1939, **89**, 544).—An instrument suitable for use in small spaces without changing the humidity is described.   L. S. T.

High resolving power ultra-centrifuge. J. W. BEAMS (Science, 1939, **89**, 543—544).   L. S. T.

Simplest transparent ultra-centrifuge. J. W. McBAIN and A. H. LEWIS (Science, 1939, **89**, 611—612).—An air-driven, transparent ultra-centrifuge permitting photographic recording of the contents of a glass or quartz tube rotating at $110,000g$ is described and illustrated.   L. S. T.

Funnel-heating device. L. N. MARKWOOD (Science, 1939, **89**, 612).—The funnel is fitted into a metal jacket and steam-tight connexions are effected by a rubber bung at the bottom and a rubber gasket at the top. Steam impinges directly on the glass funnel near the top. Alcoholic solutions can be kept at the b.p.   L. S. T.

Determination of the viscosity of liquids. C. SĂLCEANU (Compt. rend., 1939, **208**, 1797—1799).—η vals. are compared by observing the lengths of liquid column (l) displaced through a capillary tube by a const. instantaneous force, conveniently applied by a falling piston; $\eta_2/\eta_1 = (l_1/l_2)^2$. An apparatus is described.   A. J. E. W.

Micro-viscosimeter. J. R. BOWMAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 409—411).—The apparatus described and illustrated has an abs. accuracy better than 4%, and a precision within 0·1% in the range 2—10,000 centistokes. The method requires 1 drop ($\sim$0·03 g.) of sample.   L. S. T.

Edge correction in the determination of dielectric constant. A. H. SCOTT and H. L. CURTIS (J. Res. Nat. Bur. Stand., 1939, **22**, 747—775).—Theoretical formulæ for the edge correction in the determination of the ϵ of solid insulating materials using various forms of electrode are discussed. Empirical equations for the correction are derived; they are simpler to apply than the theoretical equations.   J. W. S.

C. A. Munroe. C. A. BROWNE (J. Amer. Chem. Soc., 1939, **61**, 1301—1316).   W. R. A.

Ludwig Mond. F. G. DONNAN (Proc. Roy. Inst., 1939, **30**, 709—736).

Geochemistry.

Dissymmetry of ozone distribution in the two hemispheres. (Mme.) A. VASSY and E. VASSY (Compt. rend., 1939, **208**, 1829—1830).—Vals. of the mean reduced thickness of atm. O_3 are 8—11% greater for the southern than for the northern hemisphere. The discrepancy may represent a difference in the actual amounts of O_3, or it may be due to varying distribution with latitude.   A. J. E. W.

Seasonal variations of the amounts of ozone and comparison of the amounts contained in the marine and urban regions of Rimini. F. VASCELLARI (Boll. Chim. farm., 1939, **78**, 289—296).—Details are given of the monthly variation of the O_3 content of the atm. under different climatic conditions. In general the O_3 content of sea-air is $>$ that of the urban air, especially during January to March.
          O. J. W.

Atmospheric ozone. D. BARBIER and D. CHALONGE (J. Phys. Radium, 1939, [vii], **10**, 324—325).—A reply to the criticisms of Vassy (cf. A., 1939, I, 391).
          W. R. A.

Noble gas content of air dissolved in water. J. A. M. VAN LIEMPT and W. VAN WIJK (Chem. Weekblad, 1939, **36**, 555).—Air dissolved in rain, river, or tap H_2O contains $\sim 1.8\%$ of noble gases, whilst atm. air contains 0.94%.   S. C.

Deuterium–protium ratio. I. Densities of natural waters from various sources. C. H. GREENE and R. J. VOSKUYL (J. Amer. Chem. Soc., 1939, **61**, 1342—1349).—The ρ of samples of water of widely different origins have been determined by measuring the pressure at which a Pyrex, Hg-weighted, thick-walled, stream-lined float is exactly balanced. Details of the method and of the purification of H_2O (three distillations at atm. pressure, followed by two in an evacuated all-glass apparatus) are given. During low-pressure distillation isotopic fractionation occurs and the necessary corrections have been applied, together with corrections for distillation at atm. pressure.   W. R. A.

Salinity of the subterranean waters of the western part of the interior delta of the Niger. M. ENIKEFF (Compt. rend., 1939, **208**, 2094—2097).—The salinity variations (studied by electrical resistance measurements) are discussed in relation to the origin of the waters (p_H 6·7—6·8), which contain O_2 0·0005—0·0016, Cl 0·0117—0·027, Mg 0·004—0·013, and CaO 0·084% (one sample).   A. J. E. W.

Analysis of mineral water of Pieve di Cusignano (Parma). G. ILLARI and S. BEATI (Annali Chim. Appl., 1939, **29**, 212—219).—Data for physico-chemical and chemical characteristics and for ionic activities are tabulated.   F. O. H.

Spectrographic analysis of [mineral] water of Fonte di Fiuggi [Italy]. R. INTONTI (Annali Chim. Appl., 1939, **29**, 205—212).—Metals detected in the dry residue of the H_2O are listed and discussed.
          F. O. H.

Physical chemical analysis in the chemical survey of the Marseilles canal water. F. RIMATTEI, (MME.) L. GRIMAUD, and C. GERBEAU (Ann. Hyg. Publ., 1939, **18**, 145—151).—The max. variation in the electrical conductivity of the canal water at different localities is 9·22%, increasing threefold on dilution 100 times with pure H_2O. The p_H is approx. const. at 8·0$\pm$0·2. The measured conductivity of samples agrees with that calc. from Diénert's formula, using the vals. of the OH, SO_3, and NO_3 content obtained from chemical analysis   D. F. R.

Variation of the composition of the water of Lake Geneva. P. BALAVOINE (Arch. Sci. phys. nat., 1939, [v], **21**, Suppl., 36—38).—The salt content of the surface-H_2O of Lake Geneva begins to decrease in April and continues to do so until September, after which it increases again until December. This effect, which is not observed for H_2O from a depth >25 m., is due mainly to variations in the concn. of carbonates, and is attributed to the decrease in solubility of the latter owing to the rise in temp. of the H_2O.
          J. W. S.

Organic matter in the waters of the Barentz, Polar, and Kara Seas. B. A. SKOPINTZEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 448—451).—Data showing oxidisability ($KMnO_4$ consumption) and p_H are recorded. The large variations in oxidisability at different stations are discussed. Vals. of p_H vary between 8·11 and 8·23.   L. S. T.

Spectrum analysis of the water supply of Bell Ville (Cordoba, Argentina). Determination of vanadium. F. CHAROLA (Anal. Asoc. Quím. Argentina, 1939, **27**, 35—40).—By spectrographic methods it is shown that Na, Ca, Ba, Mg, Al, Si, Mn, Mo, Fe, Cu, and K together with 1·46 mg. V per l. are present.
          F. R. G.

Distribution of ammonia in waters of the Gulf of Maine. A. C. REDFIELD and A. B. KEYS (Biol. Bull. Wood's Hole, 1938, **74**, 83—92).—In the deeper basins the $[NH_3]$ is fairly uniform at all depths in September, whereas in May it is greatest between 30 and 60 m. In the tideways the concn. at all depths was uniform both in May and September and in shallow H_2O it was irregular. The occurrence of NH_3 is similar to that of dissolved org. P compounds. The distribution with depth of NH_3 in May is closely similar to that of NO_2', supporting Rakestraw's view that the latter is formed by oxidation of the former. Both are absent from the surface layer, probably owing to assimilation by plankton. The regions of highest $[NH_3]$ are those in which zooplankton is also abundant.   A. D. H.

Analyses of the mineral waters of Varano Marchesi (Parma). II. G. ILLARI, P. PIANA, and E. LASAGNI (Annali Chim. Appl., 1939, **29**, 152—166; cf. A., 1939, I, 106).—Chemical composition and physico-chemical properties of two other waters are recorded.   O. J. W.

Clay pool containing sulphuric acid at Reinbek. W. OHLE (Arch. Hydrobiol., 1936, **30**, 604—662; Chem. Zentr., 1937, i, 1652).—The artificial pool described contains 30 mg. of H_2SO_4 per l. (p_H 3·1—3·6), resulting from the weathering of clay containing pyrites.   A. J. E. W.

[Absorption of ammonia by] snow. P. BALA-VOINE (Arch. Sci. phys. nat., 1939, [v], **21**, Suppl. 38—39).—Observations of the NH_3 content of snow and hoar-frost indicate that the absorption of NH_3 by snow occurs, not only during the snowfall, but also subsequently. J. W. S.

Rosebud meteorite, Milam Co., Texas. F. M. BULLARD (Amer. Min., 1939, **24**, 242—254).—The meteorite consists mainly of olivine chondrules in a matrix of silicate minerals, metal, and troilite. Olivine comprises >50% of the meteorite, with metal next in abundance, followed by pyroxenes (enstatite-hypersthene), and with troilite, glass, chromite (?), schreibersite, and Fe oxide (?), in small amounts. Chemical analyses of the sol. and insol. silicate and metallic portions, as well as a composite analysis, are recorded. Traces of Ge, Ba, and V were also detected spectrographically. L. S. T.

Measurement of the amount of steam escaping from areas of volcanic or solfataric activity. S. H. WILSON (Nature, 1939, **143**, 802—803).—A method is described, and results for active centres at Mt. Tongariro, N.Z., and White Island are given. L. S. T.

Marsh gas in the ecology of some peat bogs. H. A. ALLARD (Science, 1939, **89**, 533—535).—Large quantities of CH_4 are entrapped beneath the roots of sedges and org. ooze present in Grassy Pond, Oxford, Mass. The CH_4 appears to be physiologically inert and may act only as a diluent of O_2. L. S. T.

Determination of boron etc. in boron minerals. E. F. GÖBEL (Rev. Chim. Ind., 1939, **8**, 266—269).—H_2O, SiO_2, $Fe_2O_3 + Al_2O_3$, CaO, MgO, Na_2O, SO_3, CO_2, NaCl, Cl, and B_2O_3 contents are recorded for S. American ulexite and rasorite (kernite) and for Tibetan borax (tincal). F. R. G.

Lamellar structure of potash–soda felspars. S. H. CHAO and W. H. TAYLOR (Nature, 1939, **143**, 1024—1025).—X-Ray examinations of K_2O–Na_2O orthoclase felspars with microperthitic structures indicate that in both of the structure types observed the K_2O felspar is present as a monoclinic component. Further, while in the low-Na_2O type the triclinic Na_2O felspar lamellæ are twinned on the pericline law, in the high-Na_2O type they are twinned on the albite law. L. S. T.

Mica-pegmatites of Kodarma, India. S. K. ROY, N. L. SHARMA, and G. C. CHATTOPADHYAY (Geol. Mag., 1939, **76**, 145—164).—Structure and origin are discussed. L. S. T.

Kruger alkaline syenites of Southern British Columbia. C. D. CAMPBELL (Amer. J. Sci., 1939, **237**, 527—549).—The mineralogy, petrography, and genesis of the Kruger syenites are described and discussed. L. S. T.

Presence of sodium-containing orthoclase in the syenitic rocks of Divrik (Turkey). M. GYSIN (Arch. Sci. phys. nat., 1939, [v], **21**, Suppl., 39—42). —The crystal angles of the felspar occurring on the north side of the magnetite seam in Divrik indicate that it includes Na-containing orthoclase. J. W. S.

Polymorphism of the micas and diffuse X-ray scattering of layer silicate lattices. S. B. HENDRICKS (Nature, 1939, **143**, 800).—X-Ray examination of many micas reveals a great variety of structure. In biotite-like micas, the Al silicate layers are stacked in a variety of ways preserving 12-fold co-ordination of interlayer K ions. Diffuse scattering of X-rays by some biotites is a result of random combination of types of stacking. Incomplete filling of the octahedral co-ordination positions in muscovite leads to distortion of the co-ordination and therefore of the layer; as a result, there is only one way in which the 12-fold co-ordination of K between layers can be obtained. L. S. T.

Obsidian-like rock formed from the melting of a granodiorite. E. S. LARSEN and G. SWITZER (Amer. J. Sci., 1939, **237**, 562—568).—An egg-shaped inclusion of granodiorite ~50 ft. long and 40 ft. wide, included in a plug of andesite at Calaveras Quarry, San Diego Co., California, has undergone partial fusion, and appears as a black obsidian-like glass containing abundant phenocrysts of quartz, plagioclase, and augite. The perthite, biotite, and hornblende of the granodiorite have disappeared in the partly-fused mass, the perthite being incorporated in the glass, and the biotite and hornblende being replaced by diopside and Fe ore. The glass contains 4·57% of H_2O, and only H_2O has been added to the inclusion during the partial fusion. The fluxing action of H_2O probably made the fusion possible. Chemical analyses of the andesite plug, the Green Valley tonalite which is the parent rock of the inclusion, the partly-fused inclusion, and the glass of the inclusion are recorded. Photomicrographs of the fused inclusion are reproduced. L. S. T.

Granodiorite from Zsidóvár. T. TAKÁTS (Mat. Term. Értesitö Tud. Akad. III, Oszt. Fol., 1936, **54**, 882—892; Chem. Zentr., 1937, i, 1652).—The granodiorite contains SiO_2 63·12, TiO_2 0·11, Al_2O_3 18·99, Fe_2O_3 1·73, FeO 1·73, MnO 0·13, MgO 2·19, CaO 4·83, Na_2O 3·25, K_2O 2·25, P_2O_5 0·19, and constitutional H_2O 1·24%. Inclusions and cavities contain a variety of minerals, including laumontite (SiO_2 52·24, Al_2O_3 22·14, CaO 10·55, Na_2O 0·31, K_2O 0·43, constitutional H_2O 15·14%, MgO trace) and desmine (SiO_2 55·95, Al_2O_3 16·72, Fe_2O_3 0·32, CaO 7·74, SrO 0·01, Na_2O 0·78, constitutional H_2O 17·06, H_2O evolved at 100° 1·67%). A. J. E. W.

Manosque (Lower Alps) deposits of asphaltic limestone and sulphur.—See B., 1939, 822.

Vesuvianite and fluorescent apatite from Center Strafford, New Hampshire. G. W. STEWART (Amer. Min., 1939, **24**, 274—275). L. S. T.

World distribution of serpentinised peridotites and its geologic significance. H. H. HESS (Amer. Min., 1939, **24**, 275—276). L. S. T.

Pitchblende ore from Great Bear Lake, Canada. J. P. MARBLE (Amer. Min., 1939, **24**, 272—273; cf. A., 1937, I, 538).—Chemical analyses of two ore samples, one of which has provided the material for many earlier age investigations, are recorded. L. S. T.

Fluorescence experiments with secondary uranium minerals. H. MEIXNER (Naturwiss., 1939, **27**, 454).—U minerals which fluoresce strongly in ultra-violet light may be classified into two types : (a) autunite type (autunite, uranospinite, uranocircite, trögerite, etc.) and (b) schröckingerite type. The fluorescence of (a) is yellowish-green, and of (b) pure green. Differences in the position and no. of fluorescence bands occur between and within the groups. Secondary U minerals show either a weak fluorescence, or none at all. Many of those which fluoresce feebly have been altered only on the surface, or have been weathered, arising from non-fluorescing minerals (torbernite, zeunerite, bassetite, etc.). The autunite type consists of U phosphates, arsenates, and sulphates, whilst the schröckingerite type consists of U carbonates. The non-fluorescing minerals are silicates. The presence of certain metals (Cu, Pb, Bi, Fe) may cause non-fluorescence. This classification may be used to investigate the nature of a U mineral, and indicates that bassetite is $Fe(UO_2)_2(PO_4)_2,xH_2O$ ($x = 8$ or 12), and not $Ca(UO_2)_2(PO_4)_2,8H_2O$.
A. J. M.

β-Uranotile. V. STEINOCHER and R. NOVÁČEK (Amer. Min., 1939, **24**, 324—338).—β-Uranotile (I) from Joachimstal has ρ 3·953 and SiO_2 13·11, UO_3 66·29, CaO 7·32, H_2O 12·87, CO_2 present, total 99·59%, giving the formula $CaO,2SiO_2,2UO_3,6H_2O$. (I) from Bedford, N.Y., and from Mitchell Co., N. Carolina, has been incorrectly identified (A., 1935, 323) as schröckingerite. (I) from Wölsendorf has ρ 3·85 and SiO_2 12·9, UO_3 66·9, CaO 7·1, H_2O 12·6, total 99·5%. Optical data for these samples of (I) are recorded.
L. S. T.

Classification of the minerals of the serpentine group. N. E. EFREMOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 432—435).—*Kolskite*, $5MgO,4SiO_2,4H_2O$, ρ 2·401, hardness 2—3, n 1·542, occurs at Saig Lake, the Kola peninsula. The endo- and exo-thermal effects observed in a thermal analysis are those typical of serpentine minerals. The X-ray powder diagrams of this mineral and of silky chrysotile asbestos from the Markopidge region, deveilite from the Tkhacha region, and kerolite (II) from the Beden region show typical serpentine lines. With adigeite, ishkildite, hydroforsterite (I), and karachaite (III) these form a series of serpentine minerals in which the intermediate members are combinations of a mol. of the (I) type and a mol. of the (III) type, with the ratio MgO : SiO_2 varying from 2 in (I) to 1 in (II) and (III).
L. S. T.

Identity of monite, zeugite, spodiosite, and apatite. H. STRUNZ (Naturwiss., 1939, **27**, 423).—X-Ray powder diagrams of monite, zeugite [hydrated $Ca_3(PO_4)_2$], and spodiosite [$4Ca(F,Cl)_2 + 5Ca_3(P,As)_2O_8$] are identical with that of apatite. Monite ($CaHPO_4$) gives a diagram different from that of apatite.
A. J. M.

Eusynchite, aräoxene, pyrobelonite, and descloizite. H. STRUNZ (Naturwiss., 1939, **27**, 423).—Eusynchite and aräoxene (hydrated Pb Zn vanadates) gave identical X-ray powder diagrams, and eusynchite from another source was identical with pyromorphite. The name eusynchite may be extended to cover descloizite, $(VO_4/OH)ZnPb$, and aräoxene retained for descloizite containing As, $[(V,As)O_4/OH]ZnPb$. Pyrobelonite, $(VO_4/OH)MnPb$, gave a rotating crystal diagram with lattice consts. corresponding with those of descloizite.
A. J. M.

Microscopical characters of some manganese minerals found in the lateritic manganese ore of Belgaum District, S.W. India. S. DEB (Current Sci., 1939, **8**, 258—260).—Hollandite (I) and romanéchite (II) occur side by side with psilomelane and polianite, the two essential minerals of the ore. Reflecting powers of these minerals and their behaviour with HCl, H_2SO_4, H_2O_2, etc. are recorded. (I) and (II) are distinct species.
L. S. T.

Petrography and petrology of the Lower Cambrian manganese ore of W. Merionethshire. A. W. WOODLAND (Quart. J. Geol. Soc., 1939, **95**, 1—35).—The ore occurs as a band, ~1 ft. thick, interbedded with gritty and muddy rocks. The normal rocks associated with the ore, especially those above it, are markedly manganiferous. The ore is a hard flinty rock with a semi-conchoidal fracture, banded with alternations of red, yellow, and bluish-black materials. The red and yellow portions are essentially spessartite (I) and dialogite (II), with rare amounts of rhodonite. The black bands contain small amounts of pyrolusite. The colour of the red layers is due to small quantities of finely-divided hæmatite included in the (I). The MnO content of the ore varies from 37 to 49%, with a progressive increase from the red to the black material. The % of garnet varies from 50 in the red to 20 in the cream and black ores. The presence of (I) indicates considerable metamorphism. The ore is sedimentary, and was originally laid down as a mixture of (II) with clayey and siliceous materials, probably as a gel. The origin of the ore is discussed. Chemical and mineralogical analyses of the ore rock and the contained garnet are recorded.
L. S. T.

Occurrence of chrysoberyl near Golden, Colorado. W. A. WALDSCHMIDT and R. V. GAINES (Amer. Min., 1939, **24**, 267—271).—Unusually large crystals and cryst. masses of chrysoberyl occur in a granite pegmatite near Drew Hill, Golden, Colorado. The analysis [W. P. SCHODER] is BeO 19·15, Al_2O_3 76·34, FeO 3·60, TiO_2 0·55, SiO_2 and MnO traces, Cr none, loss on ignition 0·30% ; ρ is 3·648.
L. S. T.

Muscovite. G. W. VOLK (Amer. Min., 1939, **24**, 255—266; cf. A., 1925, ii, 592).—Chemical analyses and optical consts. of 22 samples of muscovite from different parts of the world are recorded. Before analysis the samples were freed from inclusions by means of heavy liquids and from free Fe oxide by means of H_2S and dil. acid. The formulæ for the three members of the muscovite system that correspond most accurately with the chemical composition are K muscovite, $H_4K_2Al_6Si_6O_{24}$, phengite (I), $H_6K_2(Fe,Mg)_2Al_4Si_6O_{24}$, and Fe^{III} muscovite (II), $H_4K_2Fe^{III}_2Al_4Si_6O_{24}$. The formula for (I) is modified from that generally accepted. η rises when the (II) content of the system increases. The optic angle decreases with an increase in the amount of (I), and when small amounts of (I) are present with large amounts of (II).
L. S. T.

Goldschmidtine, a newly-recognised antimonide of silver. M. A. PEACOCK (Amer. Min., 1939, **24**, 227—241).—Fuller details (cf. A., 1939, I, 344) are recorded.   L. S. T.

Crystal structure of nacrite, $Al_2O_3,2SiO_2,2H_2O$, and polymorphism of the kaolin minerals. S. B. HENDRICKS (Z. Krist., 1939, **100**, 509—518; cf. Gruner, A., 1933, 45, 892).—From analysis of Weissenberg and rotation X-radiograms of single crystals (Colorado), the cell is monoclinic (pseudohexagonal) with a 8·94, b 5·14, c 43·0 A., β 90° 20′; six $[(OH)_8Al_4Si_4O_{10}]$ per cell; space-group C_s^4—Cc. The layer structure found to accord with intensities is discussed with those of kaolinite, dickite, and halloysite, in terms of the OH linkage involved in the various methods of stacking the $[(OH)_4Al_2Si_2O_5]_n$.   I. McA.

Granite from Hołyczówka (Wolhynien). J. WOJCIECHOWSKI (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 96—117; Chem. Zentr., 1937, i, 1400).—The granite [quartz 32·5, plagioclase ($Ab_{92}An_8$—$Ab_{87}An_{13}$) 32·4, orthoclase + microcline 22·8, biotite 5·6, muscovite 5·3, apatite 0·3, other minerals 1·1 mol.-%] is described and compared with surrounding deposits.   A. J. E. W.

Crystallisation of the Rockville granite, Minnesota. E. TATGE (Amer. Min., 1939, **24**, 303—316).—Minerals of the granite are described and their paragenesis is discussed. A chemical analysis [F. F. GROUT and F. J. PETTIJOHN] of the granite is given.   L. S. T.

Rational quantitative mineralogical classification of granitoids. B. M. KUPLETSKI and O. I. KOVALEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 557—560).—The boundaries of a series of rock groups are defined on a tetrahedral diagram, on the basis of the proportions of quartz, orthoclase, plagioclase, coloured and secondary minerals found in a large no. of specimens.   L. J. J.

Lateritic decomposition of granite in the Macenta region (French Guinea). J. DE LAPPARENT (Compt. rend., 1939, **208**, 1767—1769).—Three stages in the decomp. are distinguished : (a) slight decomp. with formation of sericite from Ca Na felspars; (b) sand formation; (c) loss of mica and formation of kaolin from the sand, and production of gibbsite in the granite masses, which retain their mica.   A. J. E. W.

Metasomatic origin of the Adirondack magnetite deposits. H. L. ALLING (Econ. Geol., 1939, **34**, 141—172; cf. ibid., 1925, 20, 335).—Examination of numerous thin sections from most of the mines and prospects of the Adirondacks shows that the ore is due largely to high-temp. metasomatic replacement. The wall rocks show that a series of overlapping processes involving differentiation, assimilation, crystallisation, contact action, and various introductions has taken place. The textural minerals of the wall rock are described.   L. S. T.

Oxidation of magnetite. Variation of the rate of oxidation at the Curie point. R. LILLE (Compt. rend., 1939, **208**, 1891—1893).—The oxidation of natural Fe_3O_4 at 410—800° is followed by χ measurements. At <600° oxidation is rapid for ∼ 1 min. and then almost ceases owing to formation of a protective layer of Fe_2O_3; after ∼ 30 min. fissures develop in this layer, and oxidation continues slowly. At >600° oxidation is slow but continuous after ∼5 min., owing to appreciable diffusion of O_2 through the layer. An abrupt increase and a slight anomaly in the rate of oxidation occur at 570° and 675°, the Curie points of Fe_3O_4 and Fe_2O_3, respectively. The anomaly is possibly due to a change in the rate of diffusion.   A. J. E. W.

Thermal dissociation of zinc carbonate. A. ROSE (Compt. rend., 1939, **208**, 1914—1916).—Thermal decomp. of a smithsonite (I) crystal gives oriented ZnO crystals which are shown by the X-ray diagrams to have a (10Ī0) face parallel to one of the original e^3 (3Ī1) faces, and prism edges parallel to rhombohedron edges of binary axes of the original crystal. This shows that a small translation (1·9 or 2·3 A.) of Zn atoms along the [112] or [110] axes and a 0·5 A. displacement of O atoms occurs on decomp., giving the ZnO structure. The loss of CO_2 from a (I) crystal is retarded soon after commencement of decomp., owing to formation of a ZnO layer, but after a further period of heating fissures develop due to growth of the ZnO grains, and decomp. is accelerated.   A. J. E. W.

Mechanism of cation exchange in the montmorillonite–beidellite–nontronite type of clay minerals. J. E. GIESEKING (Soil Sci., 1939, **47**, 1—13).—Absorption of large substituted NH_4 ions by these clay types results in wider spacings in the crystal lattice than those produced by smaller ions. X-Ray diffraction is correspondingly intensified to extents which ultimately reach a max. val. The adsorbed large complex ions are replaceable by others of similar size but not by H˙. The complex ions are highly effective in coagulating the clay. Montmorillonite saturated with the complex ions does not show the characteristic absorption of H_2O and swelling, and the (001) lattice spacings are unaffected by the total H_2O content of the system.   A. G. P.

Silicious fossils. M. DÉRIBÉRÉ (Rev. Soc. Brasil. Quím., 1939, **8**, 47—58).—A review of the occurrence, constitution, and applications of kieselguhr, with analyses of samples from France, Algeria, Germany, U.S.A., and S. Africa.   F. R. G.

Gravitational accumulation of olivine during the advance of basaltic flows. R. E. FULLER (J. Geol., 1939, **47**, 303—313).—Late Tertiary basaltic flows in S.E. Oregon show locally a surface depletion and a basal concn. of olivine (I) above a chilled basal zone containing scattered phonocrysts of (I). The ferromagnesian grains appear to have accumulated gradually in a manner analogous to the deposition of sand at a river delta. Three chemical analyses [W. H. and F. HERDSMAN] are recorded.   L. S. T.

Viscosity of lava. R. L. NICHOLS (J. Geol., 1939, **47**, 290—302).—A study of the Alika flow of Hawaii.   L. S. T.

Pyrosynthesis, microscope study, and iridescent filming of sulphide compounds of copper with arsenic, antimony, and bismuth. A. M. GAUDIN and G. DICKE (Econ. Geol., 1939, **34**, 49—81,

214—232).—The minerals synthesised by melting the appropriate elements with S in a bomb are: chalcocite, covellite, famatinite (three varieties, and an arsenical solid solution, probably stibioluzonite), tetrahedrite (three varieties), chalcostibite, stibnite, enargite and an antimonial solid solution, probably luzonite, tennantite I and II, realgar, two As–S glasses, bismuthinite, cuprobismutite (I), klaprothite, and two allotropic (?) forms of wittichenite. The temp. at which the phases solidified are > those at which Ag sulpho-salts solidify. The solid solutions observed are of the type in which one atom of the lattice is replaced by another rather than of the interstitial type in which the lattice is disarranged. The optical character and the iridescent filming behaviour (B., 1938, 662) of these minerals are recorded and the composition and structure of the various phases, and the solid solution effects, are described and discussed. A diagram for a part of the system Cu–Bi–S is reproduced. CuS,Bi_2S_3, instead of $3Cu_2S,4Bi_2S_3$, is the formula proposed for (I).
L. S. T.

Ruby Gulch gold mining district, Little Rocky Mountains, Montana. J. L. DYSON (Econ. Geol., 1939, **34**, 201—213).—The ore deposits, which are low-grade, are worked primarily for Au. They yield some Ag. In the ore zones, quartz (I) is the most abundant mineral and pyrite (II) is common. Fluorite (III) is common locally. Some relatively high-grade ore consists of a mixture of (I), (II), (III), Au, and sylvanite (IV). The ores were deposited apparently by ascending hydrothermal solutions under conditions characteristic of epithermal deposits, and the general order of deposition was (I), (II), sericite (V), Au; (I), (II), (V), calcite (?); (III); Au and (IV).
L. S. T.

Geology of a portion of the Lupa goldfield [E. Africa]. D. GALLAGHER (Econ. Geol., 1939, **34**, 243—267).—The general geology, petrography, and data regarding the nature and origin of the lenticular Au veins are described. The region is composed of complex, pre-Cambrian, igneous rocks in which abundant Au quartz veins occur. These were deposited metasomatically in fracture channelways by solutions genetically related to a widespread invasion of the region by alaskite. A chemical analysis [F. OATES] of the alaskite is recorded.
L. S. T.

Ore geology of the Day Dawn mine, New Guinea. N. H. FISHER (Econ. Geol., 1939, **34**, 173—189).—The ore geology, the genesis of the lode, the occurrence and distribution of the Au, and the distribution of the Ag are described. Ag vals. are high, and the ratio Ag : Au is ~30 : 1, but Ag is probably mostly contained in an insol. manganite.
L. S. T.

Origin of the Sweetwater, Tennessee, barite deposits. R. A. LAWRENCE (Econ. Geol., 1939, **34**, 190—200).—These deposits are of the simple fissure-filling type and are underlain by irregular fissure-veins in Beekmantown dolomite. The veins are associated with dolomitised limestone. Calcite, pyrite, fluorite, and barite are the only common minerals of these deposits, and were deposited in this order. Deposition from ascending thermal waters is indicated.
L. S. T.

" Acidity " of quartz. G. VAN PRAAGH (Nature, 1939, **143**, 1068).—The lowering of the p_H of H_2O which results from the addition of powdered quartz is probably due not to H_2SiO_3, but to adsorbed CO_2. This view is supported by heating (300°) and cooling the quartz in a vac., after which addition to H_2O has no effect on p_H. The vol. of gas evolved is sufficient to account for the observed lowering of p_H. Addition of NaCl increases the acidity of the quartz–H_2O system owing to the decrease in $[HCO_3']$ by $Na^{\cdot}$.
L. S. T.

Unit cells of quartz and chalcedony. M. KOŁACZKOWSKA (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 82—89; Chem. Zentr., 1937, i, 1399).—Vals. of a, c (in A.), c/a, and V (in cu. A.) are as follows: chalcedony, 4·718, 5·275, 1·117, 102·20; hydrothermal quartz, 4·903, 5·393, 1·099, 112·28; granite quartz, 4·964, 5·430, 1·093, 115·93.
A. J. E. W.

Evolution of calcium phosphate in the Toarcien de l'Échelle (Ardennes). A. BONTE (Compt. rend., 1939, **209**, 53—56; cf. ibid., 1938, **206**, 1494).—A qual. analysis has been made of the different levels in a cutting at Toarcien de l'Échelle. The determination of P (as P_2O_5) in the different levels leads to the following scheme for the evolution of the phosphate: solidification, modification, dissolution, crystallisation, and diffusion.
W. R. A.

Chemical composition of zircons. E. KOSTI-LEVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 167—169).—Anomalous variations among different zircons are discussed. Reported analytical discrepancies are ascribed to neglect of traces of other elements. Varying solubility of zircons in HF is due to metamictic decomp. and to heterogeneity of composition. The extent of decomp. of Ceylon zircons into ZrO_2 and SiO_2 $\propto$ the amount of U isomorphously enclosed, and α-particles may also be the cause of green and black colorations.
J. A. K.

Herrengrundite from the Uspensky mine in Kazakhstan. F. V. TSCHUCHROV and V. M. SENDEROVA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 165—166).—Deposits on the walls of an old Cu mine had the composition $CaO,4CuO,2SO_3,6H_2O$, and have been identified as herrengrundite. Genesis of this mineral by percolating H_2O is discussed. The Uspensky specimens cannot be >40 years old.
J. A. K.

Hyalophane from the Slyudyanka mine. P. V. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 163—164).—Rocks associated with certain phlogopite veins are described. The physical properties and chemical composition of a Ba felspar similar to Swedish hyalophanes are recorded.
J. A. K.

Content of rare and other elements in the cassiterites of different genesis from U.S.S.R. deposits according to spectro-analytical data. S. A. BOROVIK and J. D. GOTMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 351—354).—Spectrum analysis of 27 specimens of cassiterites of different origin are reported and the presence of various elements is indicated. In cassiterites of pegmatite veins Nb, Ta, Zr, Fe, and Mn are present and often Ga, Be, and Hf, but no V. Cassiterites from quartz,

quartz-felspar, and sulphide cassiterite veins are quite different from those from pegmatite veins in containing considerable V and some W, In, and Mn. Wood tin contains Pb, Zn, Mo, Sb, and Ge. None of the specimens contained Ag, Cd, Co, Ni, K, As, Ba, or Sr.
W. R. A.

Allanite from the Abukuma granite region. S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 112—129).—Analyses of specimens of allanite from new localities in the Abukuma granite region confirm Machatschki's formula $X_2Y_3Z_3(O,OH)_{13}$ ($X =$ Ca, Mn, Th, rare-earth elements; $Y =$ Fe, Al, Mg, Ti; $Z =$ Si, P) (cf. Centr. Min., 1930, A, 89, 153). The amounts of Mn and of rare-earth elements in X varies widely with the locality. The colour of the streak in allanite varies from dark green to brown and is related to the proportion of Fe_2O_3 and FeO, being brown when Fe_2O_3 : FeO is > 0.35. Hardness of allanite increases with [Mn]. n of allanite increases with the concn. of rare-earth elements and Fe. The influence of Fe^{III} on n is ~ twice that of Fe^{II}.
W. R. A.

Corundum rocks in the island of Naxos (Greek Archipelago). J. PAPASTAMATIOU (Compt. rend., 1939, **208**, 2088—2090).—A kyschtymite and *naxite*, a rock of pneumatolytic origin composed of phlogopite, corundum, and plagioclase, are described in detail. Analyses [M. RAOULT]: SiO_2 34.58, 34.32; Al_2O_3 47.29, 36.46; Fe_2O_3 0.33, 0.23; FeO 1.00, 5.94; MnO trace, 0.07; MgO 0.82, 10.07; CaO 13.42, 1.92; Na_2O 0.65, 2.70; K_2O 0.55, 5.55; H_2O+ 1.41, 2.21; H_2O- 0.23, 0.10; Cl 0.05, 0.05; F 0.04, 0.76%, respectively; TiO_2 and P_2O_5, traces.   A. J. E. W.

Direction of dispersion of anisotropy in opaque minerals. L. CAPDECOMME (Compt. rend., 1939, **208**, 2086—2088).—The direction of dispersion is determined by a simple colour test under the microscope, by reflexion of polarised light.   A. J. E. W.

Structure of syngenite. A. LASZKIEWICZ (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 8—13; Chem. Zentr., 1937, i, 1399).—Syngenite, $K_2SO_4,CaSO_4,H_2O$, has a 9.70, b 7.15, c 6.20 A., β 104°, the unit cell containing a double mol.; space-group C^2_{2h}.   A. J. E. W.

Nickel-bearing slates in the Carpathians. Z. SUJKOWSKI (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 118—143; Chem. Zentr., 1937, i, 1402).—The slates occur on the Czeremosz river, and include nodules of pyrites, millerite, and arsenopyrite, and larger masses containing Mn and carbonates, with *cayeuxite*, forming dark grey nodules, ρ 3.15—3.20, hardness ~7, containing As 13, Sb 22, S 10.17, Fe 17, Ge 6, and SiO_2 15%. The red to black slates contain Ni 0.33—4.48%, with As and often Sb, but not Cu. The genesis of the deposits, which are claimed to constitute the first known occurrence of Ni in sedimentary rocks, is discussed.   A. J. E. W.

Rocks of high alkali content in Egypt. G. ANDREW (Bull. Soc. franç, Min., 1936, **59**, 338—344; Chem. Zentr., 1937, i, 1402).—A petrographic description of eruptive rocks. Cretaceous and Tertiary deposits are distinguished.   A. J. E. W.

Skolite, a new mineral of the glauconite group. K. SMULIKOWSKI (Arch. Min. Soc. Sci. Varsovie,

1936, **12**, 144—180; Chem. Zentr., 1937, i, 1401).—*Skolite*, $KH_4(Mg,Fe^{II},Ca)(Al,Fe^{III})_3Si_6O_{20},4H_2O$ (I), occurs as aggregates of parallel layers without developed crystals, giving a dark green greasy fracture; hardness 2. The strongly double-refracting crystals are probably monoclinic and cleave along (001). 4 mols. of H_2O are continuously evolved at 20—180°, (I) becoming red at 180°. 2 mols. of constitutional H_2O are evolved at $>420°$. (I) is attacked slowly by hot HCl, HNO_3, and H_2SO_4, leaving a residue of hydrated SiO_2. Glauconites occur in three groups, viz., normal (Fe_2O_3-) and Al_2O_3-glauconites, and "pholidoids," which include (I).   A. J. E. W.

Bolivian pinite from Chacaltaya. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 58—63; Chem. Zentr., 1937, i, 1401).—The pinite forms pale green weakly double-refracting needles, about equal in n to $CHBr_3$; ρ 2.8430, hardness 2.5. The composition resembles that of muscovite, Ti being absent. 8% of H_2O is absorbed on exposure to the atm. The genesis of the mineral is discussed.
A. J. E. W.

Syenite rocks of the Supsa river (West Georgia). G. G. KAZAKASCHVILI and P. A. TOPURIA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 553—556).—Two syenitic neointrusions forming dykes in Middle Eocene bends of andesite breccia and flysch are described. One has a different composition in the upper and lower portions; the other consists of a transitional rock from typical syenites to teschenites, called by the authors analcime syenite.   L. J. J.

Antlerite. C. PALACHE (Amer. Min., 1939, **24**, 293—302).—New crystallographic data are recorded. X-Ray investigation [W. E. RICHMOND] gives a_0 8.22, b_0 11.97, c_0 6.02 A., V_0 592.3; space-group D^{16}_{2h}—*Pnam*. The formula is $Cu_3SO_4(OH)_4$ and the unit cell contains 4 such mols.; $\rho_{calc.}$ is 3.93 and $\rho_{obs.}$ 3.88±0.005. Antlerite (I) is the chief Cu mineral at Chuquicamata and, in some places, is formed directly from chalcocite. Brochantite, for which (I) is commonly mistaken, is rare.   L. S. T.

Large sphene crystals from San Jacinto mountains, California. R. W. WEBB (Amer. Min., 1939, **24**, 344—346).—Large crystals occurring in granodiorite are described and illustrated. The crystals usually show inclusions of andesine and quartz. Some alteration to leucoxene has occurred in some of the sphene. The origin of the sphene is discussed.
L. S. T.

Corundum in a dyke at Glen Riddle, Pennsylvania. W. H. TOMLINSON (Amer. Min., 1939, **24**, 339—343).—Evidence that corundum is not a primary pyrogenic mineral, but that it has developed through high-temp. volatile reactions on anorthite, is advanced and discussed.   L. S. T.

Gedroizite in the alkali soils. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 565—568).—A synthetic *mineral* with the composition $Na_2O,Al_2O_3,3SiO_2,2H_2O$ has been obtained under alkaline conditions approaching those of alkali soils. X-Ray data are recorded. The new mineral (gedroizite) has been identified as a sp. constituent of soda alkali soils.   L. J. J.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

OCTOBER, 1939.

New tables of the 100,000 principal spectrum lines of the chemical elements between 10,000 and 2000 A. G. R. HARRISON (Proc. Sixth Conf. Spectros., 1938, 118—124).—Details of the method of prep. of the tables, shortly to be published, are given. A. J. M.

Ultra-violet end of the solar spectrum. M. W. CHIPLONKAR (Current Sci., 1939, 8, 312—313).—Using a simple Dobson's spectrograph, the solar spectra at Poona and at Bombay at noon in April (sun nearly overhead) had ultra-violet limits of 2895 and 2874 A., respectively. W. R. A.

Radiation measurements in the ultra-violet with the barrier-layer cell. H. KREFFT and F. RÖSSLER (Z. tech. Physik, 1936, 17, 479—481; Chem. Zentr., 1937, i, 1735).—Spectral sensitivity data (2400—7500 A.) for the Se barrier-layer cell are given. Combined glass and liquid filters for isolating four narrow ultra-violet regions are described. A. J. E. W.

Temperature of the solar chromosphere. L. GOLDBERG (Astrophys. J., 1939, 89, 673—678).—The excitation temp. of the solar chromosphere appears to increase with height, ranging from 4300° for the chromospheric slab 670 km. above the solar limb to 6700° for a height of 2330 km. L. S. T.

Spectra of two reflexion nebulæ. J. L. GREENSTEIN and L. G. HENYEY (Astrophys. J., 1939, 89, 647—652).—The spectra of the Orion nebula and of the Pleiades nebula are described. The former has a strong continuous reflexion spectrum superposed over the bright line spectrum. L. S. T.

Diffuse nebulæ. J. L. GREENSTEIN and L. G. HENYEY (Astrophys. J., 1939, 89, 653—658).—Emission line intensities in the spectrum of the Orion nebula are recorded. An electron temp. of ~5000° is indicated. Spectral characteristics of other nebulæ are recorded. L. S. T.

Physical processes in gaseous nebulæ. VI. Equations of radiative transfer. L. H. ALLER, J. G. BAKER, and D. H. MENZEL (Astrophys. J., 1939, 89, 587—593; cf. A., 1939, I, 167).—The general equations for bound–bound, bound–free, and free–free transitions for a H nebula are derived. L. S. T.

Physical state of interstellar hydrogen. B. STRÖMGREN (Astrophys. J., 1939, 89, 526—547).—The ionisation and excitation of interstellar H, its actual physical state, the ionisation of other elements, and the relative abundance of elements in interstellar space are discussed. L. S. T.

Stark-effect broadening of hydrogen lines. II. Observable profiles. L. SPITZER, jun. (Physical Rev., 1939, [ii], 56, 39—47; cf. A., 1939, I, 289).—Mathematical. N. M. B.

New emission lines in the spectrum of γ Cassiopeiæ. T. M. LIN and J. DUFAY (Compt. rend., 1939, 209, 342—344).—The emission spectrum (3750—5876 A.), photographed between October, 1937, and July, 1938, contains lines due to H, He, Fe, Ti, Mg, Al, Cr, Ni, Sr, and Ca. Lines of Fe III and other atoms with ionisation potentials <30·5 v. (N II, C II, Ti III) are also detected, and forbidden Fe II and III lines may occur. A. J. E. W.

Equivalent widths of helium lines in early-type stars. L. GOLDBERG (Astrophys. J., 1939, 89, 623—646).—Curves of growth have been constructed for the He lines in O- and B-type stars. L. S. T.

Temperature parameters from negative bands of nitrogen under excitation by electron impact. O. S. DUFFENDACK and K. T. CHAO (Physical Rev., 1939, [ii], 56, 176—184; cf. A., 1934, 823).—In a field-free space, temp. determinations along the axis of the discharge tube were made from measurements of band intensity distribution under different excitation conditions. Good agreement between theory and experiment was obtained. The change of thermal conductivity of the gas was found to account for the variation of temp. with gas pressure. The indicated temp. was independent of the accelerating potentials from 20 to 800 v. The non-transference of energy between electrons and mol. rotation is attributed to the large difference of the masses of the electrons and N_2 mols. N. M. B.

Paschen–Back effect. V. Theory of the effect for intermediate coupling. J. B. GREEN and J. F. EICHELBERGER. VI. Spectrum of neon. J. B. GREEN and J. A. PEOPLES, jun. (Physical Rev., 1939, [ii], 56, 51—53, 54—57).—V. Mathematical. General spectroscopic theory is applied and simplified methods are developed for determining the positions of the energy levels and intensities of lines for cases of intermediate coupling. They are expressed in terms of LS coupling as the zero-order functions.

VI. Methods developed above are applied to the spectrum of Ne. When applied to several lines of the $p^5p \rightarrow p^5s$ and $p^5p \rightarrow p^5d$ transitions, results are in good agreement with observed patterns. N. M. B.

Intensity ratio of the two components of the D line in the moving and stationary emission. J. STARK and H. VERLEGER (Physikal. Z., 1939, 40, 518—519).—The intensity ratio D_2/D_1 is greater for moving than for stationary emission. A. J. M.

Characteristic lines of the low-voltage arc in argon. H. KNIEPKAMP (Z. tech. Physik, 1936, **17**, 398—404; Chem. Zentr., 1937, i, 1381).—The effect of the discharge conditions on the characteristic lines, using hot and oxide cathodes, is discussed in detail.   A. J. E. W.

Pressure displacements in the second spectrum of iron. C. J. HUMPHREYS (J. Res. Nat. Bur. Stand., 1939, **23**, 125—135).—The changes in λ of the ultra-violet lines of the Fe II spectrum resulting from pressure changes of 1 or 2 atm. have been measured with Fabry–Perot interferometers. The pressure effect is only ~1 in 6×10^6 for 1 atm. pressure change and demands an increase of 0·001 A. in only five of the proposed secondary λ standards, measured by Burns and Walters, to convert from vac. arc to arc in air.   J. W. S.

New X-ray lines in the L series resulting from K Auger transitions. C. J. BURBANK (Physical Rev., 1939, [ii], **56**, 142—146).—Using a high-potential X-ray vac. spectrograph with an anode of thin Ag foil backed with Al, and precautions to suppress continuous background radiation, new X-ray lines in the L series of Ag were found at 4·030, 4·016, 3·805, and a much fainter line at 4·023 A. The lines are due to processes in which an atom, initially ionised in the K shell, undergoes transitions of the type $K \to LL +$ expelled electron (Auger transition) and $LL \to LM +$ quantum (radiative transition). The lines are more widely separated from each other and from the diagram lines than those previously observed from multiply ionised atoms.
                                           N. M. B.

Theory of the X-ray lines $LL—LM$. R. D. RICHTMYER (Physical Rev., 1939, [ii], **56**, 146—152).—X-Ray line structure to be expected from the transitions is calc. by quantum theory, and results agree satisfactorily with observation (cf. preceding abstract).   N. M. B.

Absorption and emission spectra of rare earth crystals. P. C. MUKHERJI (Indian J. Physics, 1939, **13**, 185—197; cf. A., 1938, I, 494).—Correlation of the absorption and emission spectra of the rare-earth ions has been attempted. Ce$\cdots$ ions in CeCl$_3$ and Ce$_2$(SO$_4$)$_3$ crystals emit two discrete bands, the positions of which differ slightly in the two salts but are approx. the same for hydrated and dehydrated salts. The CeF$_3$ emission spectrum consists of three discrete bands, whilst high frequency excitation causes a weak luminescence on the long-λ side of them. These bands are attributed to the true fluorescence of Ce$\cdots$ ions and, in conformity with the explanation of the corresponding absorption spectra (cf. A., 1939, I, 16), are supposed to be due to $5D \to 4F$ transitions. The two bands observed with CeCl$_3$ and Ce$_2$(SO$_4$)$_3$, and the two low-frequency CeF$_3$ bands, are due to the transitions $5^2D_{5/2} \to 4^2F_{5/2},\ _{7/2}$, whilst the third CeF$_3$ band is due to $5^2D_{3/2} \to 4^2F_{5/2}$. The $\nu\nu$ of the emission and absorption bands are related. The weak luminescence of CeF$_3$ is possibly sensitised fluorescence. The La$\cdots$ ion in crystals does not fluoresce.
                                           W. R. A.

Temperature classification of europium lines. A. S. KING (Astrophys. J., 1939, **89**, 377—430;

cf. A., 1931, 7).—$\lambda\lambda$ and temp. classifications for 3950 Eu lines from 2100 to 10165 A., ~2200 of which belong to neutral Eu, are recorded. The intensity range for both neutral and singly-ionised lines is large. An ultra-violet spark spectrum, absent from the arc, probably belongs to Eu III. Agreement of lines in the sunspot spectrum with the ultimate lines of Eu I indicates the presence of neutral Eu in the solar atm. Of the lines ascribed by Eder (A., 1918, ii, 181) to " eurosamarium," ~75% belong to known rare earths, ~ one-half being lines of Eu. Limiting $\lambda\lambda$ and the distinctive features of 17 bands appearing in the furnace spectrum of EuCl$_3$ (5695—7450 A.) are described.   L. S. T.

Differences between the M_5 and M_4 absorption edges of gold in the pure metal and in a gold–copper alloy. J. W. McGRATH (Physical Rev., 1939, [ii], **56**, 137—142).—The M_4 and M_5 edges were photographed in a vac. spectrometer. The change of lattice const. from 4·06 for gold to 3·86 A. for the alloy, which caused the energies of the lattice levels to change, produced shifts towards higher energies in Au M_5 of 2·5 and in Au M_4 of 6·8 e.v., showing that the final levels of these edge transitions are lattice levels. Results support the view that, if the same vals. of l are assigned to the low lattice levels as in free atoms, there are preferred at. to low lattice level transitions which are often given by $\Delta l = \pm 1$.
                                           N. M. B.

Zeeman effect of the hyperfine structure of optically excited mercury resonance radiation. E. H. COLLINS (Physical Rev., 1939, [ii], **56**, 48—51).—Magnetic fields of 0—2000 gauss were applied to the Hg resonance line 2537 A. and the Zeeman patterns for the hyperfine structure determined. Results agree with theory. The Paschen–Back effects for the hyperfine structure of ^{199}Hg and ^{201}Hg are worked out and experimental support is given for the view of Goudsmit and Bacher (cf. A., 1930, 265) that the Zeeman effect for the hyperfine structure may be treated in the same manner as that for the fine structure if the appropriate change in quantum nos. is made.   N. M. B.

Extinguishing and depolarisation of the mercury fluorescence by hydrogen and deuterium. F. SUPPE (Z. Physik, 1939, **113**, 141—149).—The degree of depolarisation and the extinguishing power of H$_2$ and D$_2$ on the Hg resonance line 2537 A. have been measured. In spite of their different masses and impact velocities, both particles exhibit similar quant. effects. Partial depolarisation with H$_2$ or D$_2$ is increased by addition of N$_2$ to either gas, but the strong depolarising power of N$_2$ is reduced by addition of H$_2$ or D$_2$.   L. G. G.

Regularities in the third spectrum of thorium. R. J. LANG (Physical Rev., 1939, [ii], **56**, 272—273).—Using a condensed spark in air and in N$_2$ between metallic electrodes, the Th III spectrum in the range 3500—2200 A. was investigated. 12 even and 12 odd energy vals. and the lines on which these are based are tabulated.   N. M. B.

Theory of control by quenching grids in gas discharges. F. LÜDI (Helv. Phys. Acta, 1936, **9**,

655—677; Chem. Zentr., 1937, i, 1895).—A theory is developed for the extinction of d.c. discharges in Hg vapour by a negatively charged quenching grid, based on Schottky's theory of the positive column. The calc. time of extinction is approx. equal to the experimental val. (10^{-4} sec.).   A. J. E. W.

Time of establishment of a glow discharge. R. SCHADE (Z. tech. Physik, 1936, **17**, 391—393; Chem. Zentr., 1937, i, 1381).—Non-statistical delays of 10^{-5}—1 sec. in the striking of a discharge represent the time of its establishment, which is dependent on the mechanism of development of the primary current.   A. J. E. W.

Positive column of a gaseous discharge. B. KLARFELD (Tech. Phys. U.S.S.R., 1938, **5**, 913—931).—Using the probe method, the ionisation in the positive column of a Hg-vapour discharge proceeds in a direct, non-cumulative way at pressures of ~0·001 mm. but at higher pressures it is cumulative, particularly at higher current strengths (I). For direct ionisation, potential gradient and electron temp. are independent of I but they decrease with increasing I for the cumulative ionisation. The data are discussed from the viewpoint of the low-pressure plasma theory of Tonks and Langmuir (A., 1929, 1359).   W. R. A.

Extinguishing of the arc "hot-spot" at a mercury cathode. G. MIERDEL (Z. tech. Physik, 1936, **17**, 452—455; Chem. Zentr., 1937, i, 1382).—A Hg arc is extinguished by reducing the current to zero for $\dotplus \sim 10^{-9}$ sec. This period is insufficient for appreciable change of the thermal conditions at the "hot-spot," but is ~ one order of magnitude > the time required for breakdown of the cathode field mechanism.   A. J. E. W.

Secondary electron emission. IV. Compounds with a high capacity for secondary electron emission. V. Mechanism of secondary electron emission. H. BRUINING and J. H. DE BOER (Physica, 1939, **6**, 823—833, 834—839; cf. A., 1939, I, 51).—IV. Pure NaCl has a high secondary electron emission which decreases with time as free Na accumulates. The Na arises from agglomeration of colour centres formed by loss of $3p$ electrons of Cl^-. Measurements show that not all the secondary electrons can be emitted by the colour centres. The effect of field strength on the secondary emission of MgO, and the effect of O poisoning on a BaO–SrO cathode, suggest that the resistance of the layer has a marked influence.

V. A distribution of energy levels is proposed to account for the high secondary emission of compounds of metals with closed electron shells and low ionisation energy, and the low emission of those of metals with high ionisation energy.   L. J. J.

Thermo-electronic study of molybdenum-thoria [filaments]. P. GRAUWIN (Ann. Physique, 1939, [xi], **12**, 88—160).—A detailed account of work already noted (A., 1938, I, 109).   W. R. A.

Dissociation of propane, propylene, and allene by electron impact. J. DELFOSSE and W. BLEAKNEY (Physical Rev., 1939, [ii], **56**, 256—260).—The appearance potentials of all the ions from $C_3H_8^+$

to $C_3H_2^+$ and $C_2H_5^+$ to $C_2H_2^+$ resulting from bombardment of C_3H_8, C_3H_6, and C_3H_4 were measured. Most of the reactions leading to the observed ions are specified, and this allows upper limits in the range 9—12 v. to be assigned to the ionisation potentials of the free radicals.   N. M. B.

Condensation of supersaturated vapours on ions. L. SCHARRER (Ann. Physik, 1939, [v], **35**, 619—637).—The condensation in a Wilson chamber of H_2O, EtOH, MeOH, C_6H_6, CCl_4, $CHCl_3$, PhCl, and mixtures of EtOH and H_2O and of $CHCl_3$ and EtOH, on positive and negative ions, and in the absence of ions, has been investigated, and condensation limits have been measured.   O. D. S.

Atomic beam study of the hyperfine structure of the metastable $^2P_{3/2}$ state of ^{115}In. I. Electric quadrupole moment of ^{115}In. D. R. HAMILTON (Physical Rev., 1939, [ii], **56**, 30—38).—Using the zero-moment method of at. beams, 13 zero-moment peaks were observed. Their behaviour is completely described by a hyperfine structure energy level equation, and consts. are evaluated. The total hyperfine structure separation is $0·1184 \pm 0·0015$ cm.$^{-1}$, the quadrupole moment of ^{115}In is $0·84 \times 10^{-24}$ sq. cm., and the nuclear spin is 9/2.   N. M. B.

International table of stable isotopes for 1939. F. W. ASTON, N. BOHR, O. HAHN, W. D. HARKINS, R. S. MULLIKEN, and M. L. OLIPHANT (Union Internat. Chim., 1939, 3—14; cf. A., 1938, I, 426).—The isotopes ^{36}S, ^{46}Ca, ^{48}Ca, ^{152}Gd, ^{154}Gd, ^{158}Dy, ^{160}Dy, ^{162}Er, ^{164}Er, ^{168}Yb, ^{170}Yb, and ^{176}Lu are added to the table. The abundance ratios of these elements and of Cl, Ti, Zn, Sr, Cd, Ba, and Tl are modified.   O. D. S.

At. wt. of the natural elements and their isotopes. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], **6**, 1429—1434).—Further discussion and verification of the rule (cf. A., 1939, I, 603) that the difference between the mass no. and the at. no. is an even no.   F. J. G.

Natural radioactivity of lutecium. W. F. LIBBY (Physical Rev., 1939, [ii], **56**, 21—23).—The half-life of the Lu radioactivity reported by Heyden and Wefelmeier (cf. A., 1938, I, 547) is $2·9 \pm 0·5 \times 10^{12}$ years for the element or $7·3 \pm 2 \times 10^{10}$ years for ^{176}Lu, which is probably the active isotope. Negative electrons are emitted. The upper energy limit of the spectrum is 215 ± 15 ke.v.   N. M. B.

Standardisation of radium and radon solutions. D. BUCHGRABER (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, **145**, 261—267; Chem. Zentr., 1937, i, 1369).—The ionising activity of Rn represents 49·9% of the total activity of the Rn in equilibrium with its disintegration products. The logarithmic ionisation curves for equal degrees of saturation are parallel straight lines.   A. J. E. W.

Differences in the counting of H-rays by electrical and scintillation methods. A. WAGNER (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, **145**, 175—194; Chem. Zentr., 1937, i, 1368—1369; cf. A., 1929, 1123).—The scintillation method (ZnS) may give counts 50—70% > those recorded by a counter; the difference is not due to a radiation.

The consequent uncertainty is not large in comparative scintillation measurements. A. J. E. W.

Development in time of chain reactions in a uraniferous mass. F. ADLER (Compt. rend., 1939, **209**, 301—303).—A theory of the development of chains with time (t) in a uraniferous sphere surrounded by any medium affords an expression for the crit. radius, r_c, which is identical with that of Perrin (A., 1939, I, 398). Flügge's neutron density relation (*ibid.*, 447) is also obtained for small t vals. At room temp., $r_c = 72$ cm. The no. of neutrons in the sphere increases indefinitely with t ($r > r_c$), rises asymptotically to a limiting val. ($r = r_c$), or rises to a max. and then falls asymptotically to zero ($r < r_c$). A. J. E. W.

Delayed γ-rays from uranium activated by neutrons. J. C. MOUZON and R. D. PARK (Physical Rev., 1939, [ii], **56**, 238—241; cf. A., 1939, 1, 294).—A cloud chamber in a magnetic field was operated in conjunction with a source of neutrons so as to observe γ-rays emitted during the bombardment of U by neutrons and the no. emitted ~0·5 sec. after bombardment in alternate expansions; the total no. emitted in the former case is considerably greater, although the energy distribution is about the same in the two expansions, indicating that more γ-rays are obtained which are coincident (or nearly so) with fission than those associated with a period up to several sec. N. M. B.

Neutron production and absorption in uranium. H. L. ANDERSON, E. FERMI, and L. SZILARD (Physical Rev., 1939, [ii], **56**, 284—286; cf. A., 1939, I, 294).—An attempt was made to determine whether the no. of neutrons emitted from U under the action of slow neutrons exceeds the no. absorbed. To avoid errors due to deviations from a spherically symmetrical distribution, a photo-neutron source was placed at the centre of a tank containing 10% $MnSO_4$ solution with and without U_3O_8 distributed in cylinders throughout the tank. The activity was ~10% higher with U than without, showing that more neutrons are emitted than are absorbed. About 50% of the neutrons emitted by the source are absorbed as thermal neutrons by U, and the average emission is 1·2—1·5 neutrons per thermal neutron absorbed. The possibility of maintaining a nuclear chain reaction is discussed. N. M. B.

Absorption of slow neutrons in uranium. H. REDDEMANN and H. BOMKE (Naturwiss., 1939, **27**, 518).—The absorption of slow neutrons in U, U_3O_8, and PbO_2 has been determined. The total cross-sections for Ra–Be neutrons which have passed through 2·5 cm. of paraffin, and have been filtered with Cd and Rh, are U 6±2, U_3O_8 16±3, and PbO_2 5±1 ($\times 10^{-24}$ sq. cm.). A. J. M.

Products of the disintegration of uranium by neutrons. P. ABELSON (Physical Rev., 1939, [ii], **56**, 1—9).—A detailed account of results previously reported (cf. A., 1939, I, 296, 350). N. M. B.

Uranium and thorium fission produced by fast neutrons of nearly homogeneous energy. R. LADENBURG, M. H. KANNER, H. BARSCHALL, and C. C. VAN VOORHIS (Physical Rev., 1939, [ii], **56**,

168—170).—The effective cross-section of U and Th fission for 2·4-Me.v. *d–d* neutrons is 5×10^{-25} and 1×10^{-25} sq. cm., respectively (uncertainty ~25%). The ratio of the cross-sections for Th and U fission is the same within 10% for neutrons of 2·1, 2·4, 2·9, and 3·1 Me.v. average energy. N. M. B.

Some products of disintegration of thorium. O. HAHN, F. STRASSMANN, and S. FLÜGGE (Naturwiss., 1939, **27**, 544—547).—Bombardment of Th by rapid neutrons gives rise to Ba isotopes of half-life 14 min., 300 hr., and 86 min., and I of half-life 2·3 hr. from Te of half-life 66 hr. and Mo of half-life approx. 66 hr. A. J. M.

Intensity of neutrons of thermal energy in the atmosphere at sea level. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1939, [ii], **56**, 10—12).—The no. of α-particles released in the disintegration of B by neutrons in the atm. was measured in an ionisation chamber filled with BF_3. The flux of neutrons of thermal energy was found to be 0·091±0·007 per sq. cm. per min., or one thermal neutron for every 16 ionising cosmic rays. Consequences are discussed. N. M. B.

Collision cross-sections for D–D neutrons. W. H. ZINN, S. SEELY, and V. W. COHEN (Physical Rev., 1939, [ii], **56**, 260—265).—Nuclear collision cross-sections of H, D, B, C, N, O, Na, Mg, Al, Si, S, Cl, K, Mn, Fe, Cu, Zn, Se, Mo, Sn, Hg, and Pb for 2·88±0·04-Me.v. neutrons from a D–D source were measured and found to vary irregularly with the at. wt. The proton cross-section determined for paraffin and for H_2O scatterers is $2·36 \times 10^{-24}$ sq. cm., which is < the theoretical val. The cross-sections of C, N, O, Na, Al, S, and K for 2·46-Me.v. neutrons are tabulated. Compared with the vals. for 2·88-Me.v. neutrons, there is in some cases an increase and in others a decrease. N. M. B.

Investigation of boron by slow neutrons. W. E. GOOD and R. D. HILL (Physical Rev., 1939, [ii], **56**, 288).—An ionisation chamber investigation of the ^{10}B (n, α) disintegration shows that the distribution with respect to the plane perpendicular to the incident neutron direction is symmetrical. N. M. B.

Organic compounds containing radioactive sulphur.—See A., 1939, II, 418.

Half-value period of $^{13}_{7}N$. A. G. WARD (Proc. Camb. Phil. Soc., 1939, **35**, 523—525).—A val. of 9·93±0·03 min. has been obtained for the half-val. period of $^{13}_{7}N$ by measurements of the ionisation current in A due to quantum radiations from a source enclosed in Al sufficiently thick to absorb all positrons. L. J. J.

Atomic disintegration experiments with radium-B + -C as a source of radiation. II. Nitrogen. E. FISCHER-COLBRIE (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, **145**, 283—300; Chem. Zentr., 1937, i, 1368).—Absorption measurements show that two groups of *H*-rays are emitted during bombardment of N with α-particles from Ra-C'; the energies of the corresponding processes, which indicate two energy levels in the N nucleus, are —2·8 and —1·4

Me.v. The difference between these energies represents a γ-radiation. A. J. E. W.

Recoil of the nucleus in β-decay. H. R. CRANE and J. HALPERN (Physical Rev., 1939, [ii], 56, 232—237; cf. A., 1938, I, 383).—Continued experiments on the recoil of the nucleus in the disintegration of ^{38}Cl confirm that momentum is not conserved in the system consisting only of the nucleus and the emitted electron. By measuring the momenta of the electron and nucleus, the direction of emission of the neutrino with respect to the direction of the electron in each case was found, and results tend to accord with the Fermi theory. Investigations with NO_2, CO_2, N_2O, HNO_3, NH_3, H_2O, and air as to the manner in which droplets in the cloud chamber are produced by the recoil atom indicate that the products resulting from dissociation of the gas mols. act as centres for condensation, and this effect, in addition to ionisation, accounts for the droplets observed. N. M. B.

β- and γ-Radiations from ^{64}Cu and ^{152}Eu. A. W. TYLER (Physical Rev., 1939, [ii], 56, 125—130).—Investigations with a magnetic spectrometer of high resolution show that ^{64}Cu emits both positrons and electrons of max. energy 0.659 ± 0.003 and 0.578 ± 0.003 Me.v. respectively. The spectra obtained with a very thin source contained fewer low-energy particles than those with a thicker source. The unmodified Fermi theory of β-decay is best for the thin source, while the Konopinski–Uhlenbeck modification holds for thicker sources. ^{152}Eu emits electrons of max. energy 1.885 ± 0.012 Me.v., and several γ-rays, three of which have energies 0.123 ± 0.001, 0.163 ± 0.001, and 0.725 ± 0.003 Me.v. N. M. B.

β-Ray spectra of phosphorus, sodium, and cobalt. J. L. LAWSON (Physical Rev., 1939, [ii], 56, 131—136).—Using a magnetic spectrometer of high resolving power, the shapes of the spectra in the case of P and Na showed fewer low-energy particles, because of the relative absence of scattering at the source, than previously reported, and tended to agree with the unmodified Fermi theory (cf. preceding abstract). The max. energy of the continuous electrons emitted from P and Na is 1.72 and 1.4 Me.v., respectively. The shape of the Co positron spectrum suggests two superimposed continuous distributions, and the observed upper energy limit of 1.50 Me.v. agrees fairly well with available data. The high resolution allows separation of the K and L shell conversion electrons arising from a γ-ray in In. N. M. B.

Coupling of β- and γ-rays of radio-manganese and the energy levels of the stable iron nucleus. F. NORLING (Naturwiss., 1939, 27, 432—433).—Investigation of β–γ coincidences of radio-Mn gives results in agreement with the resolution of the β-spectrum into two parts, the second being coupled with γ-rays. γ–γ coincidences were also found. A transformation and term scheme is given which embodies the experimental facts. The equation $n + {}^{55}Mn = 10$ Me.v. $+ {}^{56}Fe$ holds. Using Dempster's val. for the packing fraction of ^{56}Fe, $(-7.0\pm0.4) \times 10^{-4}$, the mass of ^{55}Mn is 54.963. A. J. M.

Existence of radioactive ^{29}Al. W. J. HENDERSON and R. L. DORAN (Physical Rev., 1939, [ii], 56, 123).—The decay curve of very pure Mg bombarded by α-particles from a cyclotron shows no evidence of ^{29}Al, and the activity previously attributed to ^{29}Al is considered to be due to Ca, present as an impurity in the Mg, giving rise to ^{43}Sc. N. M. B.

Energy released in the production of deuterium from beryllium under proton bombardment. L. S. SKAGGS (Physical Rev., 1939, [ii], 56, 24—29; cf. A., 1938, I, 489; 1939, I, 172).—The kinetic energy of the deuterons liberated in the reaction $^{9}Be\ (p, d)\ ^{8}Be$ was measured by deflecting the deuterons in an accurately known electrostatic field. From measurements at proton energies 258, 262, and 315 kv. the energy released was found to be 0.557 ± 0.006 Me.v. By combining the result with known energy data it is shown that the threshold for the disintegration of ^{9}Be by γ-rays is 1.62 ± 0.02 Me.v., and that ^{8}Be is stable with respect to disintegration into two α-particles by 0.174 ± 0.09 Me.v. N. M. B.

Self-diffusion of copper. J. STEIGMAN, W. SHOCKLEY, and F. C. NIX (Physical Rev., 1939, [ii], 56, 13—21).—Measurements were made with a radioactive isotope (^{64}Cu), prepared by neutron bombardment of Zn, and electroplated in a thin layer on the surface of a Cu disc. By measuring the decrease in β-ray emission from the sample due to the penetration of the ^{64}Cu the self-diffusion const. is found to be 11 sq. cm. per sec. exp. $(-57,200/RT)$. Methods of analysing the data are given and the significance of the variation of activation energy between self-diffusion and heterogeneous diffusion is discussed. N. M. B.

New reactions in light nuclei with high-energy protons. W. H. BARKAS (Physical Rev., 1939, [ii], 56, 287).—Evidence is given in support of the reaction $^{14}N\ (^{1}H, {}^{4}He)\ ^{11}C$ (21 min.). A curve relating activity of ^{11}C recoils to proton range is given. Bombardment of B by 5.9-Me.v. protons gave rise to a very intense ^{11}C activity attributed mainly to the reaction $^{11}B\ (p, n)\ ^{11}C$. Si bombarded with 5.8-Me.v. protons gave a strong 2.5-min. activity ascribed to the reaction $^{30}Si\ (p, n)\ ^{30}P$. There was no evidence of the reaction $^{29}Si\ (p, \alpha)\ ^{26}Al$. N. M. B.

Disintegration of deuterium by protons and p–n reactions in light gaseous elements. W. H. BARKAS and M. G. WHITE (Physical Rev., 1939, [ii], 56, 288—289).—Using D_2, H_2, O_2, N_2, CO_2, and A as targets for the proton beam from a cyclotron, an experiment to detect the reaction $^{1}H + {}^{2}H \rightarrow 2{}^{1}H + {}^{1}n$ (i) is described. Results show that from O_2, N_2, and C the neutron emission is $\ll$ from D_2, and from A about the same as from D_2, giving evidence for the reaction $^{40}A\ (p, n)\ ^{40}K$. The estimated abs. cross-section in reaction (i) for 5.1-Me.v. protons is $\sim1.4 \times 10^{-26}$ sq. cm. N. M. B.

Fission products of thorium. A. LANGSDORF, jun. (Physical Rev., 1939, [ii], 56, 205).—Several long-lived noble gases from Th irradiated with fast neutrons have been observed. One of these gases is 3-hr. Kr (probably ^{88}Kr) decaying into 18-min. Rb, probably ^{88}Rb (cf. Snell, A., 1938, I, 8). N. M. B.

Artificial radioactivity and the gaps in the periodic table. H. A. C. McKAY (Chem. and Ind., 1939, 762—763).—A review. W. R. A.

Energies released in the reactions ^{7}Li (p,α) ^{4}He **and** ^{6}Li (d,α) ^{4}He. S. K. ALLISON, L. S. SKAGGS, and N. M. SMITH, jun. (Physical Rev., 1939, [ii], 56, 288; cf. A., 1939, I, 292).—Precision re-measurement gave the energy vals. 17.28 ± 0.03 and 22.20 ± 0.04 Me.v., respectively. These vals. lead to the revised masses ^{6}Li 6.01682 ± 0.00011, ^{7}Li 7.01784 ± 0.00009, ^{8}Be 8.00766 ± 0.00015, and ^{9}Be 9.01486 ± 0.00013. (Cf. Barkas, *ibid.*, 297.) N. M. B.

Photographic investigation of atomic nuclear processes of ultra-radiation. E. SCHOPPER (Forsch. u. Fortschr., 1939, 15, 299—300; cf. A., 1939, I, 116). O. D. S.

Correlation of counter and electroscope measurements of cosmic radiation in the stratosphere. S. A. KORFF and W. E. DANFORTH (J. Franklin Inst., 1939, 228, 159—167). W. R. A.

Production of atomic and cosmic rays in supernovæ. F. ZWICKY (Proc. Nat. Acad. Sci., 1939, 25, 338—344).—Theoretical. W. R. A.

Origin of cosmic rays. F. CERNUSCHI (Physical Rev., 1939, [ii], 56, 120—121).—A mechanism for the provision of energy to explain the appearance of a supernova and the origin of cosmic radiation is proposed. N. M. B.

Study by counters of the secondary radiation of cosmic ultra-radiation at an altitude of 2300 metres. J. A. PRIEBSCH (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, 145, 101—144; Chem. Zentr., 1937, i, 1369—1370).—The intensity of the secondary component is affected to a greater extent by atm. pressure (1% per mm.) than the total radiation, indicating a soft primary radiation. The pressure coeff. increases with altitude, owing to a widening of the energy spectrum of the secondary rays. A positive temp. effect (0.5% per degree) is observed. A. J. E. W.

East–west symmetry of cosmic radiation at very high elevations near the equator and evidence that protons constitute the primary particles of the hard component. T. H. JOHNSON and J. G. BARRY (Physical Rev., 1939, [ii], 56, 219—226).—Stratosphere flight experiments indicate that the asymmetry is $<\sim 7\%$. Analysis shows that $<\sim 10\%$ of the intensity at a depth of 1 m. H_2O is attributable to unbalanced positives. Evidence is advanced that the mesotrons are produced in the upper atm., not by the primary electrons of the soft component, but by an independent primary component consisting probably of protons or some other more massive positive ion. N. M. B.

Angular dispersion of cosmic radiation in the upper atmosphere resulting from deflexions of low-energy particles in the earth's magnetic field. T. H. JOHNSON (Physical Rev., 1939, [ii], 56, 226—231).—Mathematical. It is found that at a depth of 1 m. H_2O, rays with energy >15 Me.v. lie within 30°, and half of the intensity is within 5°, of the original direction. The correction to east–west

asymmetry measurements for broadening at high elevations or for the inclusion of lower energies is negligible (cf. preceding abstract). N. M. B.

Hard showers in cosmic ultra-radiation and the second maximum of the Rossi curve. A. EHMERT (Z. Physik, 1939, 113, 234—246).—The absorption coeffs. for narrow-divergence showers in Pb, Fe, and H_2O are measured; for single particles the coeffs. are respectively slightly >0.15, 0.065, and 0.0135 per cm. A hypothesis is advanced in explanation of the second max. of the Rossi curve. L. G. G.

Supernovæ and the neutron-core stars. F. CERNUSCHI (Physical Rev., 1939, [ii], 56, 120).—Energy considerations indicate that a supernova does not represent the transition of an ordinary star into a neutron star, and that the formation of a neutron core can never produce an explosion as required to explain the appearance of a supernova. N. M. B.

Wave functions of the relativistic hydrogenic atom. L. DAVIS, jun. (Physical Rev., 1939, [ii], 56, 186—187).—Mathematical. N. M. B.

Self-consistent field, including exchange and superposition of configurations, with some results for oxygen. D. R. HARTREE, W. HARTREE, and B. SWIRLES (Phil. Trans., 1939, 238, A, 229—247; cf. A., 1937, I, 271).—Mathematical. The single electron wave functions of O^+ have been recalc. allowing for the superposition of configurations. The effect is small and does not remove the discrepancy between observed and calc. ratios of the intermultiplet separations (cf. *loc. cit.*). O. D. S.

Atom factors of positive ions. T. DERENZINI (Nuovo Cim., 1936, 13, 341—348; Chem. Zentr., 1937, i, 2092).—Atom factors for K (1.2), Na and Rb (0.4), and Sr (1.5×10^8 cm.$^{-1}$) are calc. by the Fermi statistical method for $\sin\theta/\lambda$ varying from 0 to the vals. in parentheses. Agreement with other methods is satisfactory. A. J. E. W.

Theory of particles of any spin. L. DE BROGLIE (Compt. rend., 1939, 209, 265—268).—The representation of the particle formed by fusion of two corpuscles of spin 1 is considered. The most general theory of particles of any spin is probably reached by considering the fusion of n corpuscles of spin $\frac{1}{2}$, giving a particle of max. total spin $n/2$. A. J. E. W.

Mean free path of mesotrons. H. ERTEL and W. KOLHÖRSTER (Naturwiss., 1939, 27, 550—551).—Mathematical. A simple expression for calculating the mean free path of mesotrons from the atm. pressure coeff. is deduced. The val. for the decomp. path calc. from the equation is 15.3 km., giving a val. of 2.25×10^9 e.v. for the energy of the mesotron. A. J. M.

Elastic collisions of mesons with electrons and protons. H. S. W. MASSEY and H. C. CORBEN (Proc. Camb. Phil. Soc., 1939, 35, 463—473).—Theoretical. Cross-sections for elastic scattering of mesons by protons and electrons are calc. For meson energies up to 100 times the rest energy, the results differ from those for Fermi–Dirac particles of the same mass only in the case of collisions with protons.

In a Coulomb field the cross-section for scattering of a meson of infinite energy is finite. L. J. J.

Multiple scattering of charged particles. S. GOUDSMIT and J. L. SAUNDERSON (Physical Rev., 1939, [ii], **56**, 122—123).—Mathematical. N. M. B.

Self-energy and electromagnetic field of the electron. V. F. WEISSKOPF (Physical Rev., 1939, [ii], **56**, 72—85).—Mathematical. N. M. B.

Position and width of the energy band of the valency electrons of sodium, potassium, rubidium, and cæsium. P. GOMBÁS (Z. Physik, 1939, **113**, 150—160; cf. A., 1939, I, 118).—Mathematical. The energy band widths for the valency electrons in Na, K, Rb, and Cs are 7·43, 5·12, 3·98, and 3·44 e.v. L. G. G.

Nuclear five-body problem. W. A. TYRRELL, jun. (Physical Rev., 1939, [ii], **56**, 250—255; cf. Margenau, A., 1939, I, 6).—Mathematical. Perturbational and variational calculations with single-particle Legendre functions are made for the nuclear five-body problem of ^{5}He. Positions and limits of low-lying virtual ^2P and ^2S states are examined. N. M. B.

Theory of polarisability. I. M. M. BIEDERMANN (Physica, 1939, **6**, 717—720).—Silberstein's formula is proved and applied to He. L. J. J.

Regularity in nuclear magnetic moments. E. E. WITMER (Physical Rev., 1939, [ii], **56**, 203).—Available data lead to the view that the magnetic moment μ of any nucleus is such that $14\mu = r\mu_N$, where r is a rational no., usually with a small denominator. N. M. B.

Fundamental relations of thermomagnetics. A. D. FOKKER (Physica, 1939, **6**, 791—796).—Theoretical. The interaction of a pair of magnetic atoms, and of a magnetic atom and a coil, is considered. L. J. J.

Simplified expression of the value of some complex atomic constants. L. LABOCCETTA (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 330—331; Chem. Zentr., 1937, i, 2091).—Expressions are derived for the vals. (in e.m.u.) of a no. of fundamental consts. A. J. E. W.

Present dilemma regarding the values of e, m, and h. New graphical method of presentation. J. W. M. DU MOND (Physical Rev., 1939, [ii], **56**, 153—164).—Experiments determining some function of one or more of the consts. e, m, and h are classified into groups, and the three most satisfactory experiments (the directly measured X-ray val. of e, concordant measurements of e/m, and the vals. of h/e from the limit of the continuous X-ray spectrum) are exhibited on a new type of diagram showing separately the results of all independent reliable determinations and emphasising the discrepancy graphically. It is concluded that there is some unsuspected flaw in the determination of h/e by the continuous X-ray spectrum method, and the need for renewed study of this experiment along with X-ray ionisation and excitation potentials over a wider range of voltages with better spectral resolution is stressed. N. M. B.

Structure and absorption spectrum of o-phthalaldehydic acid. B. HOÏ and L. C. KIN (Compt. rend., 1939, **209**, 221—223).—The ultraviolet absorption spectra of 3-ethoxyphthalide (I) and Na o-phthalaldehydate (II) are different, but that of (I) closely resembles that of phthalide. Solutions of o-phthalaldehydic acid in H_2O or dioxan have spectra compounded of those of (I) and (II), showing that these solutions contain two tautomeric forms. J. L. D.

Spectral study of the arylamines and their hydrochlorides. A. WOHL (Bull. Soc. chim., 1939, [v], 6, 1312—1319).—Ultra-violet extinction curves are given for NH_2Ph, o- and p-$C_6H_4Me\cdot NH_2$, as well as N-Me derivatives, o- and p-$NH_2\cdot C_6H_4\cdot OMe$, o- and p-$NH_2\cdot C_6H_4\cdot CO_2H$, m-4-xylidine, and most of the hydrochlorides in H_2O and in aq. HCl. F. J. G.

Ultra-violet absorption of diazonium salts. A. WOHL (Bull. Soc. chim., 1939, [v], 6, 1319—1324).—Extinction curves are given for diazonium sulphates derived from NH_2Ph, o-, m-, and p-$C_6H_4Me\cdot NH_2$, o-, m-, and p-$NH_2\cdot C_6H_4\cdot OMe$, o-, m-, and p-$NH_2\cdot C_6H_4\cdot CO_2H$, and β-$C_{10}H_7\cdot NH_2$. F. J. G.

Behaviour of dehydro*iso*androsterone and androsterone in the m-dinitrobenzene reaction. —See A., 1939, II, 481.

***cis*-Azo-compounds. III. Absorption spectra.** A. H. COOK, D. G. JONES, and J. B. POLYA (J.C.S., 1939, 1315—1320).—Absorption spectra of a no. of substituted cis-azobenzenes have been determined over the range 280—480 mμ., usually in CHCl₃ solution. Absorption spectra of the trans-isomerides have also been determined. The spectra of the trans-compounds usually consist of an intense (K) band (320—370 mμ.), a less intense (R) band (440—470 mμ.), and a third band at 230—270 mμ. The R band is more intense in the spectra of the cis-compounds, with λ unchanged, while the K band is sometimes displaced, but is always weaker in the spectra of the cis-compounds. Stepwise isomerisation of the azo-linkage in 1 : 4-bisbenzeneazobenzene and -diphenyl has been studied. A. J. M.

Ultra-violet absorption spectra and constitution of organic molecules. K. DIMROTH (Angew. Chem., 1939, **52**, 545—556).—A review. W. R. A.

Structure and absorption spectrum of phthalonic acid. B. HOÏ and L. C. KIN (Compt. rend., 1939, **209**, 346—348).—The extinction coeff. curves (2350—3150 A.) for solid phthalonic acid (I) and its aq. and Et_2O solutions closely resemble those for phthalide-3-carboxylic acid, showing that (I) exists exclusively in the oxylactone form under these conditions. The keto-acid form of (I), stable in 0·4% NaOH, gives a totally different curve. A. J. E. W.

Absorption spectra of some sulphur compounds. R. A. MORTON and A. L. STUBBS (J.C.S., 1939, 1321—1324).—Comparison of the ultra-violet absorption spectrum of $C_6H_4{<}^S_{NH}{>}CS$ (Ia) [alternative structure $C_6H_4{<}^S_N{>}C\cdot SH$ (Ib)] with those of

$C_6H_4{<}^{S-}_{NMe}{>}CS$ and $C_6H_4{<}^{S}_{N}{>}C\cdot SMe$ shows that $1(a)$ is correct. The compound (II) may be formulated as $C_6H_4{<}^{CMe:CH}_{NH-CS}$ or $C_6H_4{<}^{CMe:CH}_{N==C\cdot SH}$, but its absorption spectrum differs widely from that of $C_6H_4{<}^{CMe:CH}_{N==SR}$ (R = Me, Et, or Pr$^\beta$), from which it is inferred that (II) must be a thioketone if the ethers can be proved to be substituted thiolquinolines. Comparisons with the spectra of o-hydroxycarbanil, 1-hydroxybenzthiazole derivatives, and substituted quinolines and quinolones agree with the above structures. 2-*Methyl*-, m.p. 37°, -*ethyl*-, b.p. 170—175°/14 mm., and -iso*propyl*-, b.p. 170—173°/14 mm., -*thio-4-methylquinoline* are described. A. J. M.

Equilibrium between phosphorus paranitride, $(PN)_n$, and diatomic PN molecules, deduced from the band spectrum. H. MOUREU, B. ROSEN, and G. WETROFF (Compt. rend., 1939, **209**, 207—209).—The sole occurrence of PN bands in the absorption spectrum of the vapour over $(PN)_n$ at $\not< 450°$ shows that the vapour consists of PN mols. resulting from the equilibrium $(PN)_n \rightleftharpoons n$PN, and not of mols. of a polymeride. Decomp. of the $(PN)_n$ to P and N_2 occurs at >750°. The normal state of PN is $^1\Sigma$ ($\omega_e = 1337$ cm.$^{-1}$). A. J. E. W.

Absorption spectra of certain P^{III} derivatives. II. T. MIŁOBĘDZKI and W. BOROWSKI. **III.** T. MIŁOBĘDZKI and M. LEWANDOWSKI (Rocz. Chem., 1939, **19**, 507—508, 509—513).—II. Selective absorption in the ultra-violet by H_3PO_3 esters, previously reported (A., 1939, I, 238), was due to traces of C_5H_5N used in the prep. of the esters.

III. $P(OPr^a)_3$ and $PPr^aO(OPr^a)_2$ were prepared by heating a mixture of $OH\cdot P(OPr^a)_2$ and $ONa\cdot P(OPr^a)_2$. The esters do not exhibit selective absorption in the ultra-violet; addition of 0·1—0·2% of C_5H_5N causes appearance of definite absorption bands. R. T.

Structure of the triplet bands ($d^3\Pi \rightarrow a^3\Pi$) of carbon monoxide. L. GERÖ and F. SZABÓ (Ann. Physik, 1939, [v], **35**, 597—618).—Rotational structure is analysed. O. D. S.

Band spectrum of antimony monoxide (SbO). A. K. SENGUPTA (Indian J. Physics, 1939, **13**, 145—157).—The vibrational structure in the emission band spectrum of SbO (3200—6800 A.) has been analysed. The bands belong to two systems, (i) the more refrangible due to the $^2\Sigma \rightarrow {}^2\Pi$ transitions, and (ii) the less refrangible due to transitions $^2\Pi \rightarrow {}^2\Pi$. They have a common lower state with a separation of 2272 cm.$^{-1}$ between its Π-components. This lower state is, from analogy with the other members of group V(b) oxides, the probable ground state of the SbO mol. W. R. A.

Electron vibration spectrum of neodymium salt crystals. K. H. HELLWEGE (Z. Physik, 1939, **113**, 192—202).—The infra-red reflexion spectrum of $Zn_3Nd_2(NO_3)_{12},24H_2O$ is given over the range 25—58 μ. The appearance of groups of lines in the absorption spectrum in the visible region is due to superposition of lattice vibrations on electron transitions, which also causes rules governing forbidden transitions to break down. L. G. G.

Arrangement of electron bands in solution spectra. III. Light absorption of nitrous and nitric acids, and their salts and esters. G. KORTÜM (Z. physikal. Chem., 1939, B, **43**, 418—431).—Theoretical. The possible structures of HNO_2, HNO_3, and derivatives thereof in solution, and the activation and photochemical decomp. of these mols. as revealed by absorption spectra, are discussed. C. R. H.

High-frequency discharges and their application to molecular spectroscopy. P. MESNAGE (Ann. Physique, 1939, [xi], **12**, 5—87).—The use of the high-frequency electrodeless discharge as a source of band spectra is discussed and has been studied for $FeCl_2$, $FeBr_2$, $NiCl_2$, $NiBr_2$, $CoCl_2$, $CoBr_2$, $MnCl_2$, $MnBr_2$, $CrCl_3$, and the alkaline-earth iodides. Anhyd. specimens in a cylindrical tube are placed along the axis of a solenoid through which a high-frequency current passes. The salt must be heated, and the presence of Ne is essential to the ignition and maintenance of the discharge. The spectra described have mostly not been observed previously; the iodides of Fe metals show no mol. spectra. W. R. A.

Absorption spectrum of the dichromate ion at 20° K. J. TELTOW (Z. physikal. Chem., 1939, B, **43**, 375—383).—The visible absorption spectrum of Cr_2O_7'' ions, observed with thin layers (0·19 and 0·53 mm.) of $K_2Cr_2O_7$ at 20° K., contains ~20 sharp and 30 diffuse lines between 18,165 and 19,190 cm.$^{-1}$, and a continuum gradually increasing in intensity towards higher frequencies. Increase of temp. causes the intensity and definition of the lines to decrease rapidly, and at 60° K. they cannot be observed. The sharp lines are interpreted as pure electronic transitions which are split extensively as a result of asymmetrical crystal fields and the complicated nature of the Cr_2O_7'' ions. The diffuse lines, the continuum, and the temp.-dependence of the lines are due to lattice vibrations. W. R. A.

Band spectroscopic investigations on molecule formation. E. OLSSON (Naturwiss., 1939, **27**, 582—583).—In the band spectrum of AlH there are some diffuse absorption lines due to breakdown of AlH into Al and H. These lines are also emitted when there is thermal excitation. It is possible to investigate the formation of AlH from its atoms by studying the emission of these lines. If the formation of the mol. proceeds largely in this manner, the band spectrum would develop in such a way that the diffuse lines would appear first and the other lines would gradually appear, gaining in intensity until the thermal equilibrium distribution was reached. The formation of AlH can also take place as follows: $Al + H_2 = AlH + H$, and in this case AlH mols. are formed in the stable $^1\Sigma$ and $^1\Pi$ states. A. J. M.

Ultra-violet rays and the solar cycle. J. R. ASHWORTH (Mem. Manchester Phil. Soc., 1939, **83**, 81—86).—The obstruction of light by atm. pollution has been studied by determining daily the loss of visible light, and more particularly of ultra-violet rays, at Rochdale for a period of 10 years. The transparency

of the atm., which was different on weekdays and Sundays, is dependent on wind direction. The nature and origin of the ultra-violet radiation and its connexion with the sunspot cycle are discussed.

W. R. A.

7·4 μ. fundamental vibration of methyl chloride. A. H. NIELSEN and H. H. NIELSEN (Physical Rev., 1939, [ii], **56**, 274—275; cf. A., 1935, 145).—Using a prism-grating spectrometer, a new attempt to resolve the fundamental vibration-rotation band v_3 of MeCl is reported. The rotational line spacing averaged over the P and R branches is 1·15 cm.$^{-1}$, giving $48·0 \times 10^{-40}$ g. cm.^{2} for the moment of inertia A. The Q branch of the band has a satellite at a separation of $\sim$1·0 cm.$^{-1}$ towards lower frequencies, and this line is taken to be the Q branch for v_3 in Me^{37}Cl, since it agrees with the calc. position of this band when valency forces are assumed.

N. M. B.

Infra-red absorption spectrum of gaseous and liquid sulphur trioxide. H. GERDING and J. LECOMTE (Physica, 1939, **6**, 737—763).—The absorption of liquid and gaseous SO_3 has been studied at 7—20 μ. SO_3 in the vapour phase has a plane symmetrical configuration with D_{3h} symmetry, and mol. vibration frequencies 653, 1068, 1332, and probably 530 cm.$^{-1}$ In the liquid phase mol. interaction causes considerable deviation from D_{3h} symmetry, and frequencies 530, 653, 1068, and 1378—1402 cm.$^{-1}$ are found. The liquid contains a cyclic polymeride $(SO_3)_3$, with a non-planar ring S_3O_3 having C_{3v} symmetry. Data are recorded for absorption at $\sim$2 μ.

L. J. J.

Infra-red absorption of rare-earth ions. G. ROSENTHAL (Physikal. Z., 1939, **40**, 509—511).—The infra-red absorption spectra of Yt, Tu, Er, Ho, Dy, Eu, Sm, Nd, Pr, and Ce ions have been determined up to 2·5 μ. No absorption could be detected in the case of Tb.

A. J. M.

Optical properties of zinc silicate phosphors. F. A. KRÖGER (Physica, 1939, **6**, 764—778).—Excitation, absorption, and emission spectra of Zn_2SiO_4 and Zn_2SiO_4–Be_2SiO_4, activated with Mn, have been studied in the visible and ultra-violet to 2000 A. at room temp. and —180°. The phosphors are mixed crystals with Mn_2SiO_4, 0—50 mol.-% Mn. Emission at both temp. is in two bands with max. 5200 and 6100 A., attributed to electron transitions in Mn''. Absorption is in three regions, viz., <2200 A. due to lattice absorption in Zn_2SiO_4; <3000 A. due to lattice absorption in Zn_2SiO_4–Mn_2SiO_4; and a system of bands at higher $\lambda\lambda$ to 5000 A. due to electronic transitions in Mn''. Irradiation in the regions of lattice absorption gives phosphorescence and fluorescence, and in the third region gives fluorescence only.

L. J. J.

Fundamental absorption of ZnS–MnS and ZnS–CdS–MnS mixed crystals. F. A. KRÖGER (Physica, 1939, **6**, 779—784).—The long-λ limit of absorption of ZnS is at $\sim$3380 A. With MnS in solid solution a new absorption band appears, identical with that of pure MnS, and having an edge at 3650 A. Increasing additions of CdS to ZnS–MnS produce a progressive shift of the ZnS absorption towards longer $\lambda\lambda$.

L. J. J.

Fluorescence of flavins.—See A., 1939, III, 868.

J. J. F.

Fluorescence and phosphorescence of photographic layers of silver halides in gelatin at low temperatures. W. MEIDINGER (Physikal. Z., 1939, **40**, 517—518).—Investigations with a series of emulsions showed that those containing AgI fluoresced more intensely at low temp. than those containing pure AgBr. The greenish-yellow fluorescence becomes a max. at about 5% AgI. A AgCl–gelatin emulsion gave a bluish-white fluorescence when exposed to ultra-violet light. The afterglow of AgCl and AgBr layers rapidly disappears on warming, but a bright afterglow persists in the case of AgI when irradiated with ultra-violet or light of λ 4360.

A. J. M.

Metastable character of the "anlagerung" points in crystalline phosphors. M. SCHÖN (Naturwiss., 1939, **27**, 432).—Theoretical. The mechanism governing the term scheme of the absorption of a cryst. phosphor is discussed, and one agreeing well with observation in the case of sulphide phosphors is proposed.

A. J. M.

Infra-red luminescence emission of rare elements. Application to analysis. M. SERVIGNE (Compt. rend., 1939, **209**, 210—212).—The photoluminescence spectra (6000—12,000 A.) of $CaWO_4$ phosphors containing Pr and Nd are illustrated, and the $\lambda\lambda$ of the principal lines are given. Prominent series of lines at 8696—9124 and 10,772—11,188 A. are given by $\sim$5 p.p.m. of Nd, affording a sensitive test which is not vitiated by Pr, Sm, Eu, or other rare earths.

A. J. E. W.

Luminescence of sugar wafers. E. N. HARVEY (Science, 1939, **90**, 35—36; cf. A., 1939, I, 404).—Sugar wafers flavoured with wintergreen (I) give a bright greenish flash of light when broken in the dark, due to the fluorescence of (I) being added to the luminescence of the sugar. With other flavourings the effect is smaller. After displacement of air between the sugar crystals by various solvents, there is triboluminescence on grinding. Excitation of luminescence in the sugar mol. as well as electrical discharges in the gas between the crystals can therefore occur.

L. S. T.

Chemiluminescence of hydrazides of carboxylic acids.—See A., 1939, II, 425.

Raman spectrum of o-diphenylbenzene. S. K. MUKERJI and S. A. AZIZ (Indian J. Physics, 1939, **13**, 209—217).—A detailed account of work already noted (A., 1938, I, 555).

W. R. A.

Raman effect in camphor. B. M. ANAND and S. NARAIN (Indian J. Physics, 1939, **13**, 159—165).—The Raman spectra of cryst. camphor and of saturated solutions of camphor in CCl_4, CS_2, $CHCl_3$, MeOH, and AcOH are recorded and compared with existing data. $\nu\nu$ are assigned to various bonds and groupings in the mol.

W. R. A.

Raman effect. CIII—CVI. Nitrogen compounds. XIII—XVI. XIII. Alkyl carbamates.

J. WAGNER. **XIV. Acid amides, carbamide, guanidine hydrochloride.** A. W. REITZ and J. WAGNER. **XV. Alkylated acid amides.** K. W. F. KOHLRAUSCH and R. SEKA. **XVI. Condensation products of aldehydes with amines (I).** L. KAHOVEC (Z. physikal. Chem., 1939, B 43, 333—338, 339—354, 355—363, 364—374).—XIII. Raman spectra of cryst. and molten $NH_2 \cdot CO_2R$ (R = Me, Et, Pr^a, Pr^β, Bu^β) and of cryst. $NH_2 \cdot CO_2R$ (R = Bu^a, n- and iso-C_5H_{11}) are recorded. Differences between the spectra for the cryst. and molten states are discussed.

XIV. Spectra of the following are recorded and discussed : $HCO \cdot NH_2$ (liquid) ; NH_2Ac (cryst., molten, in H_2O, in EtOH) ; $EtCO \cdot NH_2$ (cryst., molten) ; $Pr^aCO \cdot NH_2$, $Pr^\beta CO \cdot NH_2$, $Bu^aCO \cdot NH_2$, $CO(NH_2)_2$ (all cryst.) ; guanidine hydrochloride (cryst., in H_2O). The effect of physical state of the amides on the spectra is discussed. The amide spectra indicate the existence of a monomeric mol. of approx. classical amide structure and a dimeride with a resonance structure. The structures of $CO(NH_2)_2$ and of the guanidinium ion are also discussed. For all the substances, however, it is concluded that experimental data are inadequate to determine their structures unequivocally.

XV. Spectra of the following are recorded and discussed : $NHAcR$ (R = Me, Et, Pr^a, Bu^a), NMe_2Ac (all liquid) ; $CO(NHMe)_2$, $CO(NHEt)_2$, and $NH_2 \cdot CO \cdot NEt_2$ (all cryst.). Contrary to the results of other investigators, N-alkylated amides exhibit a NH valency frequency of normal intensity. It is concluded that the spectral complications of acid amides are not the result of enolisation.

XVI. The prep., Raman spectra, and structure for the following Schiff's bases are discussed : $NMe \cdot CHR$ (R = Me, b.p. 27—28°, Et, b.p. 51·5—53·5°, Pr^a, b.p. 80—82°, Pr^β, b.p. 68—70°), and for various N-trialkyltrimethylenetriamines, $(NR \cdot CH_2)_3$ (R = Me, Et, Pr^a, Pr^β, b.p. 102—104°/11 mm., Bu^a, Bu^β, iso-C_5H_{11}). In the Schiff's bases, the trans-forms exist almost exclusively and no enolisation to $R \cdot NH \cdot CH \cdot CHR'$ occurs. W. R. A.

Association of Raman frequencies of less than 1400 cm.$^{-1}$ with longitudinal vibrations in elongated organic molecules. L. SIMONS (Soc. Sci. fenn., Comm. phys.-math., 1936, 8, No. 16, 12 pp.; Chem. Zentr., 1937, i, 1406).—A theory of Raman ѵѵ for a linear chain of 2—8 atoms of equal mass is developed, and comparison is made with Raman data for a no. of org. mols. at ѵѵ ~1400 cm.$^{-1}$, which is the upper limit of longitudinal vibrations in a C-chain. The no. of Raman lines in this region increases with the no. of C atoms; the lines are segregated in groups, the mean ѵѵ of which are in approx. agreement with theory. Deviations from the calc. ѵѵ are caused by the angles in the C-chain, and by attached groups. Numerical agreement occurs only with a mol. of elongated form giving Raman lines of the correct state of polarisation.

A. J. E. W.

Behaviour of the Raman bands of water in solutions of some sulphates. F. CENNAMO (Nuovo Cim., 1936, 13, 304—309; Chem. Zentr., 1937, i,

1891).—The max. of the H_2O Raman band at ~3500 cm.$^{-1}$ have been measured for aq. solutions of $CuSO_4$, $MnSO_4$, and $FeSO_4$. A. J. E. W.

Raman spectra of crystalline powders. Hydrates. E. CANALS and H. COLLET (Compt. rend., 1939, 209, 212—214).—$MgSO_4$,7, 6, and $1H_2O$, Na_2HPO_4,12, 7, and $2H_2O$, and $CuSO_4$,5 and $3H_2O$ give broad, diffuse Raman bands (3100—3900 cm.$^{-1}$) with several max., the ѵѵ of which are recorded. The most persistent band occurs at ~3400 cm.$^{-1}$; with Na_2HPO_4 the ν of this band decreases with the no. of H_2O. No apparent relation exists between the Raman spectra of different hydrates of the same salt, salts of the same degree of hydration, or hydrates of the same cryst. form. In general the bands become wider as the no. of H_2O is reduced. A. J. E. W.

Secondary electron emission of pure metals in the ordered and disordered state. R. SUHRMANN and W. KUNDT (Naturwiss., 1939, 27, 548).—The dependence of the efficiency of secondary electron emission, S/P (S = secondary electron current, P = primary electron current), on crystal structure can be determined with thin films of metals deposited at low temp. (83° K.) in a high vac. At low temp. such films are disordered, the orientation becoming more complete as the temp. is raised. To investigate the effect of lattice order on the secondary emission, S/P has been determined for such films with varying accelerating potentials of the primary electrons, between 83° and 293° K. For Cu, Ag, and Au, S/P for the disordered state was > that for the ordered state. If a new film is deposited on an ordered film at low temp. this shows the higher efficiency at low temp. of the disordered state. After warming and re-cooling the smaller efficiency of the ordered state is found. A. J. M.

Effect of adsorbed oxygen on the secondary electron emission of pure metals at 83° and 293° K. R. SUHRMANN and W. KUNDT (Naturwiss., 1939, 27, 548).—The curve of efficiency of secondary electron emission against accelerating potential of primary electrons is considerably higher at 83° K. than at 293° K. for films of Cu, Ag, and Au which had adsorbed O_2 at room temp. It is considered that this result can be explained by a change in the mol. state of the adsorbed O_2 with temp. There was no change in the secondary electron emission when mol. H_2 was adsorbed. A. J. M.

Theory of electrical breakdown of solid insulators. W. FRANZ (Naturwiss., 1939, 27, 433—434).—The hypothesis of von Hippel that electrical breakdown of solid insulators depends on ionisation by electron collision is discussed in connexion with a calculation by Fröhlich (A., 1937, I, 444), which, however, is paradoxical. A more accurate calculation, taking into account the widths of energy bands of conductivity electrons, gives field strengths which are of the right magnitude but are considerably affected by temp., contrary to experiment. A wave-mechanistic treatment is necessary to overcome this discrepancy. A. J. M.

Effect of pressure on the positive point-to-plane discharge in N_2, O_2, CO_2, SO_2, SF_6, CCl_2F_2, A, He, and H_2. H. C. POLLOCK and F. S. COOPER (Physical Rev., 1939, [ii], **56**, 170—175).— The voltage at which corona first appears in a 3-mm. point-to-plane gap and the breakdown voltage of the gap were determined, with point both positive and negative, and over a pressure range of ~30 atm., for the gases alone and for some mixtures. Voltage–pressure curves are given and types of corona are discussed. There is a marked dependence of the positive point breakdown voltage on pressure in those gases which form negative ions. N. M. B.

Electric moments in some homologous series. P. TRUNEL (Ann. Chim., 1939, [xi], **12**, 93—168).— The degree of interaction between the substituent groups in compounds of the type $X \cdot [CH_2]_n \cdot X$ has been studied by determination of the dipole moments of a no. of diamines (C_2—C_8) and dinitriles (C_3—C_{12}) in C_6H_6 solution at 25° and 45° or 75°. For the diamines μ is independent of temp. and agrees with vals. calc. for free rotation about the C·C bond. For the dinitriles μ is < the val. for free rotation, the divergence decreasing with rise of temp. and with increasing chain-length from C_6, becoming negligible at C_{12}. The relative divergence is a max. at C_6, and this cannot be attributed to association, for the cryoscopic mol. wts. are normal, nor to the presence of a cyclic isomeride, for $[R]_D$ is normal. Other instances of anomalous behaviour at chain-lengths C_6 are cited. The following are described : ω-*bromoundeco-amide*, m.p. 88°, and -*nitrile*, n_D^{25} 1·4704 ; αω-*dicyanodecane*, m.p. 20°, n_D^{25} 1·4492 ; ε-*bromohexonitrile*, b.p. 120—130°/11 mm. F. J. G.

Temperature-independent negative Faraday effect. G. GASSMANN (Ann. Physik, 1939, [v], **35**, 638—656).—The magnetic rotation of the plane of polarisation of light, and its variation with λ and with temp., have been measured for crystals of $TiCl_4$, $UO_2(NO_3)_2,6H_2O$, $K(UO_2)(MeOAc)_3,H_2O$, $Ba[(Cl,Mn)O_4]_2,3H_2O$, Al_2O_3, $CuCl$, $K_4[Fe(CN)_6],3H_2O$, $Na_2[Fe(CN)_5,NO],2H_2O$, and $[Co(NH_3)_6](ClO_4)_3$, and for a supercooled melt of $UO_2(NO_3)_22H_2O$, solutions of TiO_2,UO_3, and WO_3 in borax glass, and aq. CrO_3. A strong negative Faraday effect, independent of temp., is shown by compounds containing transition ions in a state of high valency. Results are compared with the theory of Serber (A., 1932, 1077). O. D. S.

Resonance and physical and chemical properties of diphenyl types.—See A., 1939, II, 412.

Critique of the pair theory of mesomerism. E. H. LLOYD and W. G. PENNEY (Trans. Faraday Soc., 1939, **35**, 835—840).—Energies of the bonds in $(CH_2:CH)_2$, $C(:CH_2)_2$, $(CH:C)_2$, and C_6H_6 are considered. Although the regular hexagon structure for C_6H_6 is the most stable it is easily distorted. F. R. G.

Structure and energies of some hydrocarbon molecules. J. E. LENNARD-JONES and C. A. COULSON (Trans. Faraday Soc., 1939, **35**, 811—823).— A review of theoretical valency rules in mols. (cf. Coulson, A., 1939, I, 243). The C to C bond energies and lengths deduced are in agreement with experi-

mental vals. The properties of mobile electrons permit the transmission of influences from one part of a mol. to another, and also help to form a temporary union between two mols. such as $(CH_2:CH)_2$ leading to polymerisation, and modification of the electric and magnetic properties. F. R. G.

Normal vibrations and the configurations of hydrazine. I. Group theory calculations. K. SCHÄFER (Z. physikal. Chem., 1939, B, **43**, 409—417).—Selection rules for infra-red and Raman spectra of possible configurations of N_2H_4 are derived. C. R. H.

Vibration–rotation energies of the non-linear triatomic XY_2 type of molecule. W. H. SHAFFER and H. H. NIELSEN (Physical Rev., 1939, [ii], **56**, 188—202).—Mathematical. The energies and their dependence on the consts. occurring in the potential energy function are examined quantum-mechanically. N. M. B.

Applications of magnetism, particularly in inorganic chemistry. W. KLEMM (Z. Elektrochem., 1939, **45**, 583—592).—A review. J. W. S.

Magnetism and organic chemistry. E. MÜLLER (Z. Elektrochem., 1939, **45**, 593—597 ; cf. A., 1938, I, 565).—A review of the relationship between the structure and magnetic behaviour of org. mols. including the K compounds of ketones. J. W. S.

Order and disorder in pure liquids and solutions. J. H. HILDEBRAND (Science, 1939, **90**, 1—8).—A lecture. L. S. T.

Nature of the bond between dipolar molecules and the central ion in the inner sphere of complex compounds. A. M. SHARNOVSKI and B. E. HAISINSKI (Chimia, 1936, 7—23).—The *salts* $Rb[AuI_4]$, $Rb[TlI_4]$, $Rb_8MAu_6I_{22}$ (M = Be, Mg, Ca, Zn, Cd, Hg), and $Rb_5MTl_2AuI_{16}$ (M = Zn, Cd, Hg) are described. Their thermostability rises with increasing complexity, but falls with increasing ionic radius of M, being smaller for the alkaline-earth than for the Zn group. Attempts to prepare salts with Sr or Ba in the inner sphere were unsuccessful. The stability of the more complex salts is related to resonance between the electronospheres of the inner sphere atoms and the nucleus, this leading to establishment of attractive forces ≫ those expected on the basis of the electrostatic theory. R. T.

Structure of proteins.—See A., 1939, II, 461.

Constitution of cellulose with special regard to hydrolytic experiments. O. ANT-WUORINEN (Suomen Kem., 1939, **12**, A, 103—108).—Dissolved cellulose (I) is hydrolysed preferentially at the middle of the chains. Native or repptd. (I) is not hydrolysed uniformly, chains forming part of the crystal lattice having a different chemical resistance from chains in the amorphous interlattice region. Crystallites of native (I) are more cohesive than those of repptd. (I). Mols. of native (I) are probably too long to dissolve in any solvent ; irreversible fission always precedes dissolution. M. H. M. A.

Van der Waals forces. H. MARGENAU (Rev. Mod. Physics, 1939, **11**, 1—35).—A crit. discussion of the forces between polar mols., between non-polar

mols., and between excited mols., based on the theory of London (A., 1937, I, 116). Tables of calc. consts. are given. W. R. A.

Nuclear magnetic moments of the boron isotopes. S. MILLMAN, P. KUSCH, and I. I. RABI (Physical Rev., 1939, [ii], **56**, 165—167).—Using the mol. beam magnetic resonance method with $Li_2B_4O_7$, $Na_2B_4O_7$, $K_2B_4O_7$; $NaBO_2$, and KBO_2, the nuclear Landé g vals., in units of $e/2Mc$, are 0.597 ± 0.003 and 1.788 ± 0.005, and evidence is given for assigning these to ^{10}B and ^{11}B, respectively. Assuming respective nuclear spin vals. of 1 and 3/2, the magnetic moments are 0.597 ± 0.003 and 2.682 ± 0.008 nuclear magnetons, respectively. N. M. B.

Ridges in a liquid surface due to the temperature dependence of surface tension. A. V. HERSHEY (Physical Rev., 1939, [ii], **56**, 204).—Experiments show that the existence of a ridge at each border of a layer of a pure liquid draining from a flat vertical surface is due to the effect of temp. on surface tension, and is analogous to the occurrence of tears on the sides of a glass containing strong wine. The phenomenon is analysed mathematically. N. M. B.

Derived Patterson analysis of the skeleton of the cyclol C_2 molecule. D. P. RILEY and I. FANKUCHEN (Nature, 1939, **143**, 648—649).—Vector maps of the C and N atoms of the skeleton of the cyclol C_2 mol. are derived. The results indicate that Crowfoot's X-ray data (A., 1938, I, 300) afford no direct evidence for the cyclol structure of insulin (cf. Wrinch, *ibid.*, 502). J. W. S.

Vector map of the cyclol C_2 molecule. E. H. NEVILLE (Nature, 1939, **143**, 803).—A criticism (cf. preceding abstract). L. S. T.

Diffraction of X-rays at very small angles. Application to the study of ultramicroscopic phenomena. A. GUINIER (Ann. Physique, 1939, [xi], **12**, 161—237; cf. A., 1938, I, 454, 611).—Full details are given of the investigation of systems of small dispersed particles by the diffraction of monochromatic X-rays at small angles. O. D. S.

Scattering of X-rays from crystals. (A) Total. (B) Alleged discontinuities in diffuse scattering at small angles. G. G. HARVEY (Physical Rev., 1939, [ii], **56**, 242—247, 247—249).—(A) Mathematical. A general formula for the total intensity of X-radiation scattered by a general crystal in any direction is derived.

(B) The positions of discontinuities, reported by Laval (cf., A. 1936, 15), in the diffuse scattering from crystals all occur at places corresponding with reflexions of radiation of $\lambda/2$, $\lambda/3$, etc. of the main beam. For Al, an experiment designed to accentuate the expected effect shows, not discontinuities, but peaks corresponding with reflexions of radiation of half the primary λ, indicating that Laval's reported effect probably does not exist. N. M. B.

X-Ray fluorescing coefficient and the orientation of a zinc crystal. O. J. BALTZER and G. E. M. JAUNCEY (Physical Rev., 1939, [ii], **56**, 289).—An experiment is described which indicates that the coeff. of X-ray fluorescence (K characteristic rays) is not a function of the orientation of an anisotropic crystal such as Zn. N. M. B.

Some problems connected with crystal-growth. H. E. BUCKLEY (Mem. Manchester Phil. Soc., 1939, **83**, 31—62).—A lecture. W. R. A.

Radiated crystals in cast stearin. C. G. CARLSON and A. HULTGREN (Jernkont. Ann., 1936, **120**, 577—587; Chem. Zentr., 1937, i, 1894).—Plates of stearin cast in moulds at 5° $<$ the m.p. and etched with C_6H_6 exhibit a radiating cryst. structure which resembles that of cast steel, except that the striations are bent. Experiments described show that this bending is due to a convection current in a direction opposite to that of crystal growth. A. J. E. W.

Crystal structure of hexamethylbenzene and the length of the methyl group bond to aromatic carbon atoms. L. O. BROCKWAY and J. M. ROBERTSON (J.C.S., 1939, 1324—1332).—The crystal structure of C_6Me_6 has been reinvestigated using the double Fourier series method, and the early results of Lonsdale (A., 1929, 750) have been corr. Projection along the c axis gives an electron-density contour diagram in which two of the Me C atoms are clearly resolved. The distance between these C atoms and the centre of the ring is 2·92 A., and the Me bond length ($C_{al.}$—$C_{ar.}$) is 1·53 A., equal to the distance $C_{al.}$—$C_{al.}$ and agreeing with the val. found by electron diffraction (Pauling and Brockway, A., 1937, I, 448). The min. intermol. approach distances are 3·70 and 3·87 A. between C atoms and 2·0—2·2 A. between H atoms. The C_6Me_6 mols. are packed as closely as H–H repulsions will allow. A. J. M.

X-Ray diffraction patterns of *Hevea*, manihot, and other rubbers. G. L. CLARK, S. T. GROSS, and W. H. SMITH (J. Res. Nat. Bur. Stand., 1939, **23**, 1—5).—Rubber from *Manihot glaziovii* has been separated into Et_2O sol and gel fractions which have been examined by X-rays. The stretched sol and gel yield a few and many interferences, respectively. After crystallising by freezing at $-20°$ for 24 hr. the gel still showed more interferences than the sol. The measurements accord with those obtained with *Hevea* rubber (A., 1938, I, 29). X-Ray examination of frozen specimens of rubber obtained from *Funtumia elastica*, *Cryptostegia grandiflora*, and *Castilloa elastica* indicates that all the rubbers have similar structure. The spacing of 54 A. previously observed in unstretched *Hevea* gel rubber has been observed, together with a spacing of about 108 A. in a stretched specimen. J. W. S.

Temperature-dependence of the system cellulose–sodium hydroxide–water. H. SOBUE, H. KIESSIG, and K. HESS (Z. physikal. Chem., 1939, **B**, **43**, 309—328).—During the systematic investigation of the influence of temp. on the action of aq. NaOH of varied concns. on natural cellulose fibres, two new *Na-celluloses* have been found, viz., V at 12—25% NaOH, 5° to $-10°$, and Q at 7—8% NaOH, $-5°$ to 1°, respectively. The X-ray diagram of V, which has a rhombic elementary cell, a 9·92, b 26·1, c 15·3 A., resembles that of Na-cellulose II, whilst that of Q is similar to that of Na-cellulose IV. W. R. A.

Fibre period of sodium cellulose I. H. Sobue (Z. physikal. Chem., 1939, B, 43, 329—332; cf. preceding abstract).—Consideration of new X-ray pictures of Na-cellulose I confirms the order of 20 A. for the fibre period, in support of the data of Hess and Trogus (A., 1931, 1219).   W. R. A.

Superstructure in FeNi₃. F. E. Haworth (Physical Rev., 1939, [ii], 56, 289; cf. A., 1939, I, 11).—A specimen containing 73·8% Ni heated at 490° for 6 days and then cooled to 440° in 14 days gave superstructure lines with 16 hr. exposure to X-rays, confirming Leech and Sykes (cf. A., 1939, I, 412). Unlike the case of Cu₃Au, it appears that lowering of resistance does not first occur at the same temp. at which ordering becomes sufficient to be detected by X-rays.   N. M. B.

X-Ray study of potassium chlorochromate, KCrO₃Cl. S. Gawrych (Rocz. Chem., 1939, 19, 413—417).—The unit cell consists of 4 mols. of KCrO₃Cl, and has a 7·83₂, b 7·46₅, c 7·82₁ A., β 88° 36′. The crystals belong to the monoclinic-prismatic system, space-group C_{2h}^5—P_1^2/c.   R. T.

Crystal structure of the pressure modification of potassium nitrate. T. F. W. Barth (Z. physikal. Chem., 1939, B, 43, 448—450).—KNO₃ III belongs to the ditrigonal pyramidal system, space-group C_{3v}^5, with a_0 4·365 A., α 76° 56′. The K—O distance is 2·95 A.   C. R. H.

[Structure of] double copper ammonium bromide. M. A. Silberstein (Bull. Soc. franç. Min., 1936, 59, 329—337; Chem. Zentr., 1937, i, 1398).—CuBr₂,2NH₄Br,2H₂O (tetragonal) has a 7·98, c 8·41 A., c/a 1·054, the unit cell containing 2 mols.; space-group D_{4h}^{14}—$P4/mnm$. At. parameters are given. Each Cu atom is surrounded by 2 O and 4 Br in a distorted octahedron, the interat. distances being Cu—O 2·20, Cu—Br 2·46 and 3·14 A.   A. J. E. W.

Electron diffraction with low voltages. J. J. Trillat (Compt. rend., 1939, 209, 201—203).—Satisfactory electron diffraction photographs (by reflexion or transmission) have been obtained with accelerator potentials of ~3500 v. (~10 ma.), using an external camera focussed on the fluorescent screen, and exposures varying from 30 sec. to several min. Plates treated with oil or Na salicylate may be used internally with ≮ 4000 v., but longer exposures are required.   A. J. E. W.

Electron diffraction studies of thin films. I. Structure of very thin films. L. H. Germer (Physical Rev., 1939, [ii], 56, 58—71).—Thin films having calc. thicknesses ~1 at. layer, deposited on org. supporting foils by vaporisation in high vac., were investigated by electron diffraction by the transmission method in the case of Au, CsI, Sb₂O₃, Pd, Cu, CuCl, Ni, CaF₂, Al, Mg, NaF, and Be, and satisfactory diffraction patterns characteristic of three-dimensional crystals were obtained. The ionic compounds produce films made up of rather large crystals, 100 A. or more on a side, even in the thinnest films; metal films are, in general, made up of smaller crystals. Observations prove that atoms and mols. can move over the surface of the supporting foil, and that they are drawn together into crystals of considerable size. Crystals in metal films are randomly oriented, except for slight orientation in Al films; crystals of some ionic compounds have strong preferential orientation, others are randomly oriented. No correlation is observed between average crystal shape and degree of orientation. Intensity anomalies are observed in diffraction patterns from CaF₂ and CuCl.   N. M. B.

Electron distribution in zinc oxide crystals. H. M. James and V. A. Johnson (Physical Rev., 1939, [ii], 56, 119; cf. Yearian, A., 1935, 1452).—Deviations from calc. vals. of intensities in the electron diffraction pattern are attributed to the valency electrons, and observed intensities are approx. accounted for by assuming a concn. of valency electrons in the region between each Zn and its nearest O neighbour. Agreement with observed strong lines is given by a distribution of three electrons over ellipsoids (axes 2·1 and 0·35 A.) which enclose each pair of Zn–O nearest neighbours.   N. M. B.

Electronic states at the surfaces of crystals. IV. Activation of adsorbed atoms by surface electrons. E. T. Goodwin (Proc. Camb. Phil. Soc., 1939, 35, 474—484).—In the case of excitation of an adsorbed atom by surface electrons of an underlying metal, the mean life time in a typical excited level is $3·7 \times 10^{-11}$ sec. The effect is negligible in conductors, but may be appreciable in semiconductors and insulators.   L. J. J.

Magnetism and metal research. E. Vogt (Z. Elektrochem., 1939, 45, 597—608; cf. A., 1938, I, 391).   J. W. S.

Problems of dia- and para-magnetism. C. J. Gorter (Z. Elektrochem., 1939, 45, 615—621). —The magnetic behaviour of metals, particularly in the superconducting state, and of salt hydrates is discussed.   J. W. S.

Problems of ferromagnetism. W. Döring (Z. Elektrochem., 1939, 45, 621—629).—A review. Spontaneous magnetisation, the magnetisation curves of various alloys, and the practical applications of ferromagnetic materials are discussed.   J. W. S.

Influence of mechanical strains on ferromagnetic properties. H. Schlechtweg (Ann. Physik, 1939, [v], 35, 657—664).—Theoretical. The alteration in the exchange energy between neighbouring atoms, due to distortion of the crystal lattice, leads to a spatial variation in the wall energy between neighbouring elementary zones, and thence to a Barkhausen effect independent of magnetostriction and crystal anisotropy.   O. D. S.

Electrical resistance of single molybdenum crystals under the action of strong transverse and longitudinal magnetic fields. A. Foroud and E. Justi (Physikal. Z., 1939, 40, 501—506).— The resistance of single Mo crystals was determined over the temp. range 4·2—373° K., under the influence of strong external magnetic fields (up to 35,000 gauss). Mo shows a resistance anisotropy in the magnetic field, the anisotropy factor being independent of field strength. Mo follows Kohler's rule that the relative increase of resistance in the field is independent of temp., and is a function only of the ratio

of field strength to resistance without the field. Mo thus has the Ba type of mechanism for electrical conduction. The resistance of Mo without the field decreases below $20°$ K., approx. $\propto T^2$. The characteristic temp. of Mo is $384°$, and the normal temp. coeff. (over the range $0—100°$ c.) is 0.471% per degree. A. J. M.

Calculation of the Peltier effect. J. A. CHALMERS (Proc. Camb. Phil. Soc., 1939, **35**, 521—522).— By considering a virtual current at const. electron density instead of const. vols. of the metals, Fowler's val. for the Peltier coeff., derived thermodynamically, is increased by a factor of 3. L. J. J.

Experimental study of some cases of paramagnetism. G. FOËX and (MLLE.) M. GRAFF (Compt. rend., 1939, **209**, 160—162).—χ for Cr_2O_3 (prepared by ignition of $K_2Cr_2O_7$), after an initial increase with temp., obeys the Weiss law at $>100°$, and gives the 19·1 magneton moment of $Cr^{\cdots}$. This effect is due to the disappearance of the antiparallel orientation of interaction moments which accounts for the const. paramagnetism of Cr. CrSb and $CrSb_2$ also lose their paramagnetism at $\sim400°$, but the $1/\chi$–T variation is complex; thermal anomalies also occur in the temp. regions for which χ is max. The Weiss const. Θ has a high negative val. in each case. A. J. E. W.

Magnetic after-effects at higher inductions. J. L. SNOEK (Physica, 1939, **6**, 797—805).—A specimen of Fe containing 0.006% of C in solid solution shows the effect already described (A., 1939, I, 186) in a much higher degree. The reluctance r $(1/\mu)$ is composed of a const. term r_0 and a time- and temp.-dependent term $r_1 \propto$ the concn. of dissolved C or N. The max. in the curve of r as a function of temp. becomes less pronounced, and occurs at a higher temp., the higher is the induction. L. J. J.

Paramagnetic relaxation in gadolinium sulphate. W. J. DE HAAS and F. K. DU PRÉ (Physica, 1939, **6**, 705—716).—By means of a mutual inductance bridge the differential susceptibility of $Gd_2(SO_4)_3, 8H_2O$ has been measured in an external magnetic field up to 1820 gauss at temp. down to $1.3°$ K. For the lower temp., the results are in agreement with theory (cf. A., 1938, I, 391), and the relaxation time is $\sim10^{-2}$ sec. The heat capacity from the susceptibility data is in agreement with direct measurements, giving $0.00032T^3$ g.-cal. per $\frac{1}{2}$ mol. for the lattice vibrations and $0.56T^{-2}$ g.-cal. per $\frac{1}{2}$ mol. for the spin system. The overall splitting of the lowest level in $Gd^{\cdots}$ due to the electric field in the crystal is $1.17°$ K. L. J. J.

Magnetic measurements with long rods of considerable cross-section of steel and the newer alloys. H. SCHMIDT-GLENEWINKEL (Physikal. Z., 1939, **40**, 519—533).—Rods of circular cross-section and bars of prismatic section were used for the determination of magnetic properties. The effect of eddy currents was negligible. The dimensions of the test-piece have no effect on the magnitude of the demagnetisation factor. The magnetic properties of some new Al alloys have been investigated. The alloys used [bondur (Al–Cu–Mg), B6 sea-H_2O (Al–Mg), pantal (Al–Mg–Si), and mangal (Al–Mn)] were weakly magnetic. Data are also given for a Be alloy (B7M), an Fe–Ni alloy (V2A), and Riefler steels. A. J. M.

Magnetic susceptibility of manganous fluoride, MnF_2, **at low temperatures.** H. BIZETTE and B. TSAÏ (Compt. rend., 1939, **209**, 205—206).—At $-201°$ to room temp., $\chi_M = C_M/(T - \theta)$, with $C_M = 4.08$ and $\theta = -113.2°$ K., giving an at. moment of 5·73 Bohr magnetons (theoretical val., 5·92). MnF_2 has a transition point at $-201°$, below which χ decreases with falling temp., and increases slightly with the magnetic field. A. J. E. W.

Supersonic phenomena. W. T. RICHARDS (Rev. Mod. Physics, 1939, **11**, 36—64).—A review dealing with the theory of the propagation of plane sound waves, the experimental determination of the velocity and absorption of sound, and the physical and chemical effects of sound waves of large amplitude. A comprehensive bibliography is given. W. R. A.

Velocity of sound in liquid helium under pressure. J. C. FINDLAY, A. PITT, H. G. SMITH, and J. O. WILHELM (Physical Rev., 1939, [ii], **56**, 122; cf. A., 1938, I, 607).—Previous measurements for He evaporating under its own v.p. are extended for He under 1—5 atm. pressure, and results are plotted. Changes in compressibility at the λ-transition for various pressures are tabulated. N. M. B.

Stroboscopic phenomena due to passage of light through two ultrasonic wave-trains. R. BÄR (Helv. Phys. Acta, 1936, **9**, 678—688; Chem. Zentr., 1937, i, 1366).—A stroboscopically interrupted light beam passing through an ultrasonic wave-train ($\not<1000$ kc. per sec.) gives visible fringes, the separation of which is the λ of the sound waves. An unmodulated beam passing through two successive wave-trains also gives stroboscopic effects, which are applied to the study of unevenly propagated waves (7000—10,000 kc. per sec.). A. J. E. W.

Birefringence measurements in the far ultraviolet. R. SERVANT (Compt. rend., 1939, **209**, 206—207).—Vals. of the birefringence (b) of barytes $(n_m - n_p)$ and gypsum $(n_g - n_p)$ at $\not<1700$ A. are recorded. b increases rapidly in the neighbourhood of absorption bands, b for barytes in the Schumann region being $\sim$ six times its val. in the visible spectrum. A. J. E. W.

Specific heat of gases at high temperatures. R. W. FENNING and A. C. WHIFFIN (Phil. Trans., 1939, **238**, A, 149—228).—The mean mol. heats at const. vol., C, between $373°$ K. and temp. from $2370°$ to $3060°$ K. of CO, N_2, and CO_2 have been measured by comparison with the mol. heat of A by the method of matched explosions. C for H_2 and H_2O has been measured by the explosion method between $373°$ and 2090—2930° K. $C_{CO} = 4.854 + 0.0_37725T - 0.0_7875T^2$. $C_{N_2} = 4.795 + 0.0_37675T - 0.0_7875T^2$. $C_{CO_2} = 8.631 + 0.001522T - 0.0_615T^2$. $C_{H_2} = 4.089 + 0.0_3953T - 0.0_798T^2$. $C_{H_2O} = 4.874 + 0.002284T - 0.0_6256T^2$ (T = upper temp. in $°$ K.). Vals. agree fairly well with spectroscopic data. Apparatus for measuring the compressibility of gases is described. O. D. S.

Heat capacity of potassium dihydrogen phosphate at the Curie point. C. C. STEPHENSON and J. G. HOOLEY (Physical Rev., 1939, [ii], **56**, 121).—The heat capacity–temp. curve shows a large anomaly at 122° K. in agreement with theory.   N. M. B.

Specific heat of cobalt from 2° to 18° K. G. DUYCKAERTS (Physica, 1939, **6**, 817—822).—Data obtained by means of heating curves are in agreement with the expression $c = 1\cdot20 \times 10^{-3}T + 464\cdot5(T/443)^3$ g.-cal. per g.-atom per degree. The first term represents the electronic, and the second term the lattice, sp. heat.   L. J. J.

K. Schäfer's work on the thermal properties of ortho- and para-hydrogen and ortho- and para-deuterium. K. COHEN and H. C. UREY (Z. physikal. Chem., 1939, B, **43**, 432—438).—Recent conclusions by Schäfer (cf. A., 1939, I, 311) which conflict with those of the authors (cf. *ibid.*, 248) are criticised.   C. R. H.

Theory of the solid state and the m.p. G. MOLIÈRE (Ann. Physik, 1939, [v], **35**, 577—596).—Mathematical.   O. D. S.

Equations of state and thermodynamics. N. V. KARPEN (Bull. Acad. Sci. Roumaine, 1939, **21**, 199—205).—A re-presentation and expansion of demonstrations formerly noted (A., 1929, 387, 498, 1144).   F. J. G.

Critical state and a new general equation of state. R. PLANK (Forsch. Gebiet Ingenieurw., A, 1936, **7**, 161—173; Chem. Zentr., 1937, i, 2336).—An equation of the fifth degree in v, applicable to normal and associated substances for $v \gg v_c$ and $p \not> \sim 3p_c$, is evolved.   A. J. E. W.

Effect of compression on the homogeneous systems ethylene and air–ethylene in the critical region. R. L. MCINTOSH, J. R. DACEY, and O. MAASS (Canad. J. Res., 1939, **17**, B, 231—240).—The effect of compression on the d of C_2H_4 above and below the crit. temp., 9·50°, and also over a narrow region near this temp. (∼0·3°) has been determined; at 9·17° spontaneous condensation occurred. Above 9·50° compression of a homogeneous system re-creates heterogeneity. Below 9·17° the liquid appearing on condensation is increased in d and amount by compression. Between these temp. condensation is brought about and a liquid separates subsequent to compression. It is suggested that the system, although apparently homogeneous, is still a two-phase system and that temp. variations bring about the mutual dispersion of the two phases. The re-creation of heterogeneity has also been observed with C_2H_4–air mixtures.   C. R. H.

Physical properties of compressed gases. VI. Fugacity of carbon dioxide. W. E. DEMING and (Mrs.) L. S. DEMING (Physical Rev., 1939, [ii], **56**, 108—112; cf. A., 1935, 1313).—Michel's compressibility data for CO_2 (cf. A., 1937, I, 453) for 0—150° and 0—3000 atm. are smoothed and interpolated graphically, and the fugacity f is computed at certain integral pressures. The ratio f/p decreases with p to a min. at ∼600 atm. for all isotherms above crit.; it then increases, and fugacity first equals and then exceeds p.

At 50°, $f = p$ at 2435 atm.; at 150°, $f = p$ at 1675 atm.   N. M. B.

Critical, pre-critical, and post-critical phenomena. W. ŚWIĘTOSŁAWSKI (Rocz. Chem., 1939, **19**, 375—386).—Apparatus for observation of the crit. state of liquids is described. The pre-crit. state is that of co-existence of liquid with mist, and in this state the surface tension of the liquid is only slightly > zero, and its d > that of the vapour. At the crit. point the mist disappears. The existence of a post-crit. state is postulated at temp. and pressures > the crit.   R. T.

Conduction of heat. H. S. CARSLAW and J. C. JAEGER (Proc. Camb. Phil. Soc., 1939, **35**, 394—404).—Theoretical. A solution of the problem of conduction of heat in a system consisting of a solid spherical shell which has an inner surface at a const. temp., and is bounded externally by an infinite solid of a different material, is obtained.   L. J. J.

Formulæ for calculating compressibility and thermal expansion. R. GIANASSO (Nuovo Cim., 1936, **13**, 355—365; Chem. Zentr., 1937, i, 2102—2103).—Formulæ for the compressibility, vibration νν, and thermal expansion of ionic crystals of various lattice types are considered, and tested by experimental data.   A. J. E. W.

Flow and viscosity of liquid helium. H. E. JOHNS, J. O. WILHELM, and H. G. SMITH (Canad. J. Res., 1939, **17**, A, 149—163).—The flow of liquid He I and He II through capillaries of a wide variety of sizes and for a wide range of pressure differences has been measured. For He I the vol. per sec. flowing through the capillary strictly ∝ the pressure head and η can be calc. from Poiseuille's formula. η decreases as temp. falls, in agreement with previous work. For He II the flow is expressible as a laminar flow obeying Poiseuille's law and of the same magnitude as for He I, together with a residual flow independent of the pressure head. Residual flow takes place in darkness but increases with increasing light intensity. The mechanism of residual flow is apparently connected with the ponderomotive effect which accompanies a temp. gradient in He II. Light absorption by the reservoir walls causes a slight temp. difference between the reservoir and the surrounding vessel. On the other hand, small pressure differences can also cause residual flow without input of thermal energy. Residual flow is further discussed in connexion with the fountain effect, high heat conductivity, and other properties.   C. R. H.

Viscosities of chemically related liquids, and their dependence on mol. wt. and molecular volume. II. D. T. LEWIS and A. R. MORGAN (J.C.S., 1939, 1341—1345; cf. A., 1938, I, 446).—By considering the η of Ph halides it is shown that the intercept, α, of the Andrade equation $\log \eta = \beta/T - \alpha$ is primarily determined by the mol. vol. PhF is a normal member of the series of Ph halides as regards the η relationship. The equation $\log \eta = A(\log \bar{M})/T + x \log P + \log y$ is derived for a series of related liquids (x and y are consts. for the series, M = mol. wt., P = parachor, A is const.). There is good agreement between vals. of η calc. from this equation and those

observed for the series of Pr halides. The equation is also applied to fused salts, but the data available do not permit a crucial test.   A. J. M.

Relation between chain length and viscosity of polyoxyethylene glycols.—See A., 1939, II, 402.

Oiliness of liquids. VII. Static frictional coefficients of esters, ketones and glycerol. T. ISEMURA (Bull. Chem. Soc. Japan, 1939, **14**, 270—273; cf. Akamatu et al., B., 1938, 478 etc.).—The static frictional coeffs. μ for various esters and ketones are : MeOAc 0·87; EtOAc 0·81; Pr^aOAc 0·81; Bu^aOAc 0·78; $n\text{-}C_5H_{11}\cdot OAc$ 0·74; $n\text{-}C_8H_{17}\cdot OAc$ 0·73; $EtCO_2Et$ 0·80; Pr^aCO_2Et 0·80; $COMe_2$ 0·86; COMeEt 0·83; $COEt_2$ 0·84; COPhMe 0·73. For glycerol μ is 0·86; revised figures for H_2O and MeOH are 0·90 and 0·79, respectively. These results, obtained by placing the various liquids between glass plates, are very high and indicate the unsuitability of the compounds as lubricants. It is suggested that since the esters and ketones have their polar groups near the middle of the mol. they cannot easily orient themselves regularly with respect to the sliding surface. Glycerol has a high μ by virtue of its three polar groups which can all attach themselves to the glass.   T. H. G.

Oiliness of liquids. VIII. Measurements of static friction coefficients for silver surfaces. T. ISEMURA (Bull. Chem. Soc. Japan, 1939, **14**, 297—302). —Vals. of the static friction coeff. μ are given for H_2O and for hydrocarbons, alcohols, acids, and esters of the paraffin series, between clean Ag surfaces. The lubricating effect of H_2O and the hydrocarbons, including C_6H_6, is almost nil. For acids, alcohols, and esters, μ decreases generally in each group with increasing length of the C chain. With glass (A., 1937, I, 294) similar results were obtained for all substances except acids, for which μ was nearly independent of the no. of C atoms.   F. L. U.

Equation of state for gas mixtures. I. R. KRITSCHEVSKI and J. S. KAZARNOVSKI (J. Phys. Chem. Russ., 1939, **13**, 378—396).—A semi-empirical equation for the total pressure, p, of a binary gas mixture is proposed : $p = p_1^0 N_1 + p_2^0 N_2 + aN_1N_2(p_1^0 - p_2^0)$, where p_1^0 and p_2^0 are the pressures of the components for a vol. equal to the mol. vol. of the mixture, N_1 and N_2 the mol. fractions of the components, and a is a const. which can be a function only of the temp. (cf. A., 1938, I, 611). It agrees with existing data for a wide range of temp., pressure, fugacity, and composition.   R. C.

Thermal diffusion in mixtures of the inert gases. B. E. ATKINS, R. E. BASTICK, and T. L. IBBS (Proc. Roy. Soc. 1939, **A**, 172, 142—158).— Measurement of the thermal separation of all pairs of inert gases was made, and the repulsive force index obtained. In all cases the index decreases as a heavier mol. is substituted for a lighter one in a mixture.   G. D. P.

Duhem's equation and Raoult's law. J. JAŹWIŃSKA (Przemysł Chem., 1939, **23**, 207—210).— For binary liquid mixtures Raoult's law is a mathematical consequence of Duhem's equation; both hold only when the heat effect of mixing the liquids is zero, and when the saturated or unsaturated vapours

behave as ideal gases. This does not apply to azeotropic $EtOH\text{-}H_2O$ mixtures.   R. T.

Liquid mixtures separated into two layers and critical opalescence. P. MONDAIN-MONVAL and J. QUIQUEREZ (Kolloid-Z., 1939, **88**, 140—144).— Examination of a large no. of binary and ternary mixtures of partly miscible liquids shows that no opalescence is observed when the difference between the refractive indices of the constituents is $\gg 0.03$. As the difference increases opalescence appears, at first slight and restricted to the immediate neighbourhood of the crit. point, and later (difference > 0.15) strongly marked and extending over a greater range of temp. and composition. The opalescence is an indication, crude compared with that afforded by viscosity measurements, of the existence of a colloidal emulsion near the crit. point.   F. L. U.

Physical constants of hydrocarbon mixtures. II. A. V. LOZOVOI, M. K. DJAKOVA, and T. G. STEPANTZEVA (J. Gen. Chem. Russ., 1939, **9**, 540— 546).—NH_2Ph points, n_D^{20}, and d_4^{20} are recorded for the binary systems alkylbenzene–alkyl*cyclo*hexane (alkyl = Bu^a, n- and *iso*-amyl, n-octyl), o- or p- $C_6H_4MePr^a$–1-methyl-2- or -4-n-propyl*cyclo*hexane, hydrindene–octahydrindene, and tetrahydronaphthalene–decahydronaphthalene. n-*Octyl*cyclohexane, b.p. 117—119°/11 mm., is described.   R. T.

Theory of solutions. II. Significance of partial molar quantities in the theory of solutions. K. FREDENHAGEN and W. SCHULZE (Z. physikal. Chem., 1939, **B**, 43, 439—447; cf. A., 1938, I, 399).— Theoretical. For a solution containing dissolved A and B, the partial mol. vol. (v_A) and mol. energy (u_A) of A are defined as the rate of change of total vol. (V) and energy (U) of the solution with change in the no. of mols. of A. The conclusion that v_A and u_A correspond with the true vol. and energy of A is correct only if V and U for the solution are linear functions of the no. of mols. of A. This condition is fulfilled if v_A and u_A = the mol. vol. and mol. energy of pure A. Deviations from linearity are due to reciprocal action between A and B.   C. R. H.

Effect of an electric field on the viscosities of liquids [solutions]. O. KIMURA (Bull. Chem. Soc. Japan, 1939, **14**, 243—249).—Using a modified Ostwald viscosimeter, to the capillary of which an electric field can be applied, η has been measured for solutions of lauric (I), myristic, palmitic, and stearic acids (II) and of cetyl alcohol (III) in C_6H_6 and in C_6H_{14}, with and without an applied field. η increases with the field. This effect ($\Delta\eta$) increases with the length of the mol. and is $\propto$ concn. With (I) $\Delta\eta$ increases linearly with the voltage, but with (II) no further increase occurs beyond a certain voltage. (III) shows a stepwise increase of $\Delta\eta$ with voltage. The electro-viscous effect is due to the orientation of the mols. of the solute, the irregularities with (III) and (II) being apparently caused by association.   T. H. G.

Dielectric properties of carbon monoxide–hæmoglobin solutions mixed with foreign substances. S. ARRHENIUS (Physikal. Z., 1939, **40**, 534—539).—The dielectric properties of solutions of

CO-hæmoglobin containing glucose, glycerol, $CO(NH_2)_2$, and glycine were investigated over the λ range 90—3000 m. In all cases the dipole moment is slightly < that of the aq. solution without the addition of foreign substances. The relaxation times for glucose and glycerol are < those calc. The results are discussed. A. J. M.

Physical chemistry of cystine peptides. J. P. GREENSTEIN, F. W. KLEMPERER, and J. WYMAN, jun. (J. Biol. Chem., 1939, **129**, 681—692).—The dielectric properties of diglycylcystine (I) are identical with those of its isomeride cystinyldiglycine (II) and their dipole moments are calc. to be 30·2. From titration data for (I) and cystine, titration consts. and actual acidity consts. are calc. The apparent mol. vol. of (I) is 199 c.c. compared with 194 c.c. for (II). E. M. W.

[Constitution of] solutions of nitric acid in diethyl ether. R. DALMON (Compt. rend., 1939, **209**, 413—414).—The constancy of ε in the ultraviolet with varying concn. shows that Et_2O solutions of HNO_3 (≯30%) contain a single species of absorbing mol. The solutions do not nitrate cellulose, showing that this mol. is not the pseudo-form of HNO_3, as supposed by Hantzsch, but is probably a HNO_3–Et_2O compound. Solutions containing free nitrous vapours deposit NH_4NO_3 on keeping. A. J. E. W.

Relation between viscosity and concentration of mixtures of molten salts. A. G. STROMBERG (J. Phys. Chem. Russ., 1939, **13**, 436—445).—The viscosity, η, of 0·05—0·7ɴ. solutions of AgI in HgI_2 at 270—450° and of 0·009—0·5ɴ. solutions of KCl in $SbCl_3$ at 100° is a linear function of the concn. It is inferred that here η is determined by the hydrodynamic factors postulated in Einstein's theory of the viscosity of sols, rather than by electrostatic effects. R. C.

Transformations of the metastable β-phase in copper–zinc alloys. E. KAMINSKI (Tech. Phys. U.S.S.R., 1938, **5**, 953—967).—In Cu–Zn alloys a martensite transformation of the β phase occurs and in alloys containing a certain amount of impurities the body-centred β phase lattice is changed on quenching into the face-centred tetragonal α′ lattice. This is due to an initial change from the disordered β lattice to an ordered lattice of the CsCl type followed by the body-centred to the face-centred transformation. The α′ lattice is unstable, but it can exist at room temp. for a very long time. On tempering it changes to the cubic α lattice, very slowly at 100° but more rapidly at higher temp. and at 200° it takes place in ~30 min. In quenched alloys a supersaturated β phase exists which on tempering decomposes into α + β phases through intermediate formation of a ζ phase between 200° and 270°. Production of the ordered α′ lattice by quenching alloys containing impurities has been investigated; in the absence of impurities no ordered α′ lattice was found. The transformation temp. is lowered as the concn. of Zn increases. W. R. A.

X-Ray study of recrystallisation of copper and α-brass. V. I. IVERONOVA and H. S. SCHDANOV (Metallwirts., 1936, **15**, 1086—1088; Chem. Zentr., 1937, i, 1894).—The temp. of recrystallisation of α-

brass falls with increasing [Zn] (5—40%). Two successive stages are distinguishable in the recrystallisation of Cu, viz., growth of the individual grains, and aggregation to a massive structure, but abrupt formation of the massive structure occurs in α-brass. The dependence of the grain size and rate of recrystallisation on the previous thermal treatment is studied. A. J. E. W.

Binary alloy system Ag–Te. V. KOERN (Naturwiss., 1939, **27**, 432).—The Ag–Te system has been investigated by thermal, microscopic, and X-ray methods. Only two compounds exist, Ag_2Te and $Ag_{12}Te_7$, both occurring in two modifications. α-Ag_2Te (low-temp. modification) is apparently orthorhombic, a 13·0, b 12·7, c 12·2 ᴀ. α-$Ag_{12}Te_7$ is hexagonal, a 13·429, c 8·4508 ᴀ., $n = 3$. Space-group D_{6h}^1—$C6/mmm$ or D_6^1—$C62$. A. J. M.

Age-hardening of copper–aluminium alloy.—See B., 1939, 946.

Kinetics of deposition processes on the basis of magnetic measurements. H. AUER (Z. Elektrochem., 1939, **45**, 608—615).—Magnetic methods of detecting and investigating phase changes in ferrous and non-ferrous metals and alloys by magnetic measurements are discussed. A quenched sample of Al–Cu alloy (5% Cu) shows changes in magnetic susceptibility (χ) during age-hardening at room temp., χ varying linearly with log t (t = time of keeping). If the sample is kept at room temp. and subsequently heated at 200° χ returns to its initial val. before increasing again at the rate which would be anticipated. Experiments with samples aged at 100° indicate that this behaviour depends on the stage to which the aging has progressed, and the temp. to which it is subsequently heated, more advanced stages of hardening and lower temp. of heating favouring only a partial decrease in χ before the final increase. The interpretation of the results is discussed. J. W. S.

Niobium–iron alloys. R. GENDERS and R. HARRISON (Iron & Steel Inst., Sept., 1939, Advance copy No. 2, 9 pp.).—The phase diagram of the Nb–Fe system is of the same type as that of the Ta–Fe system. Alloys containing ≯50% of Nb can be considered as an alloy of Fe and Fe_3Nb_2. Addition of >1% Nb to Fe increases hardness. Further hardening is obtained by tempering at 700° after quenching. The phase diagram for alloys containing ≯6% of Nb completes and in general confirms that of Eggers and Peter (cf. A., 1939, I, 18, 19). Micrographs are given. C. R. H.

X-Ray investigation of the iron-rich nickel-iron alloys. A. J. BRADLEY and H. J. GOLDSCHMIDT (Iron & Steel Inst., Sept., 1939, Advance copy No. 1, 17 pp.).—X-Ray powder photographs of Ni–Fe alloys containing 0—35 at.-% Ni indicate that the γ–α transformation is spontaneous during the quenching of alloys containing <20% of Ni. Slow cooling tends to retain a certain amount of face-centred cubic structure in alloys containing >6% Ni. This effect is partly reversed if the alloys are immersed in liquid air. Annealing experiments indicate that the alloys are divisible into four ranges, viz., 0—6, 6—25, 25—

40, and 40—100% of Ni. The upper temp. limit to the two-phase α–γ range is 580°, all alloys containing >12% Ni being pure γ above that temp. The lower temp. limit to the range is 350°, at which temp. the α and γ phases react to form a phase with the approx. composition Fe_3Ni. Comparison is made between the alloys examined and the alloy Invar. The latter appears to be a supersaturated γ solid solution which, under certain heating conditions, may ppt. Fe_3Ni. An equilibrium diagram has been constructed.
C. R. H.

Properties of aluminium bronzes containing beryllium.—See B., 1939, 950.

Magnetic study of the iron–nickel–aluminium system. W. SUCKSMITH (Proc. Roy. Soc., 1939, A, **171**, 525—540).—The magnetic saturation intensity has been measured for >80 alloys in the system at temp. up to the Curie point. Each phase region exhibits characteristic features and the magnetic effects accompanying order–disorder transformation are studied. G. D. P.

System iron–cobalt–tantalum. W. KÖSTER and G. BECKER (Arch. Eisenhüttenw., 1939—40, **13**, 93—94).—The phase boundaries in the region enclosed by Fe–Co–Co₅Ta₂–Fe₂Ta have been delineated at various temp. and are illustrated by a triangular diagram for 20°, and a perspective of the solid model. The hardest alloys are the martensitic ones containing 20—80% Co, at 8 and 10% Ta; a max. hardness at 50% Co occurred. R. C. M.

System iron–nickel–tin. P. SCHAFMEISTER and R. ERGANG (Arch. Eisenhüttenw., 1939, **13**, 95—103).—The phase boundaries have been delineated at temp. up to 1500° in the region bounded by Fe–Ni–Ni₃Sn₂–Fe₂Sn. The two last-named compounds form a complete set of mixed crystals. Four primary mixed crystals occur, α, γ, ε (Fe₂Sn–Ni₃Sn₂), and non-magnetic β (Ni₃Sn). Two four-phase invariant points were found. Brinell hardness, remanence, and coercivity were determined for typical ferritic (Ni 5, Sn 15%), martensitic-austenitic (Ni 30, Sn 6%), and pure austenitic (Ni 62, Sn 9%) alloys after quenching from 1000° and annealing for 30 min. at various temp. up to 800°. The first alloy had a high max. hardness after annealing at 600°, the second a high max. coercivity after annealing at 700°, the temp. at which the martensite–austenite transition proceeds most rapidly. The pure austenite alloy had low vals. of all the three properties. The magnetic observations are in general agreement with those of Legat (B., 1938, 293). R. C. M.

Hydrogen bonding by negatively substituted CH groups. VI. Acetylenic compounds. M. J. COPLEY and C. E. HOLLEY, jun. (J. Amer. Chem. Soc., 1939, **61**, 1599—1600; cf. A., 1939, I, 20).—The solubility of C_2H_2 in 17 solvents shows the same type of deviation from Raoult's law as does that of $CHCl_2F$, the C:C having the same effect as the electronegative halogen in activating the H. The heat of mixing of CH:CPh with NMe₂Ac, Et₂O, COMe₂, *cyclo*hexylamine, and MeOAc is a max. for 1 : 1 mixtures, indicating existence of 1 : 1 mol. compounds.
R. S. C.

Solubility of barytes in distilled water. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 75—81; Chem. Zentr., 1937, i, 1391—1392).—A solution containing 0·00126 g. of $BaSO_4$ in 100 c.c., which exhibits Brownian movement, is prepared by heating finely-powdered barytes (2 g.) with H_2O (530 c.c.) at 203—206° for 49 hr., in a Pt-lined tube. The rapid separation of $BaSO_4$ from this solution explains the observed decrease of electrical conductivity of aq. $BaSO_4$. The occurrence of colloidal $BaSO_4$ in nature is also explained. A. J. E. W.

Solubility of zinc and cadmium nitrates in liquid ammonia. D. B. DONSKAJA and M. A. PORTNOV (J. Gen. Chem. Russ., 1939, **9**, 526—531).—The solubility curve of $Zn(NO_3)_2$ in NH_3 consists of a no. of branches, corresponding with the ammoniates $Zn(NO_3)_2,10NH_3$ (−75° to −55°), $Zn(NO_3)_2,8NH_3$ (−55° to 0°), $Zn(NO_3)_2,6NH_3$ (0—58°), and $Zn(NO_3)_2,4NH_3$ (>58°). The crit. temp. of solubility is 61°. The solubility rises from −81° to −77·5°, above which it falls continuously. R. T.

Solutions of metallic cadmium in molten chlorides. S. KARPATSCHEV and A. STROMBERG (J. Phys. Chem. Russ., 1939, **13**, 397—405).—The potential of a C electrode in a solution of Cd in a molten mixture of CdCl₂, KCl, and NaCl at 700° is given by $E = $ const. $- 2·3(RT/2F)$ log [Cd], indicating that the Cd is dissolved as single atoms. The solubility of Cd in mixtures of the above chlorides has been deduced from e.m.f. measurements, the results being confirmed by direct determination. R. C.

Precipitability of hemicolloidal polyoxyethylene glycols.—See A., 1939, II, 402.

Halogen cyanides. II. Distribution of cyanogen bromide and iodide between benzene and water, and between benzene and some aqueous salt solutions. Synthesis and mol. wt. of cyanogen iodide. M. MØLLER (Kong. Dansk. Vidensk. Selsk., mat.-fys. Medd., 1936, **14**, No. 3, 37 pp.; Chem. Zentr., 1937, i, 1412—1413).—The activities of CNI and CNBr in very dil. aq. solution are deduced from distribution measurements between C_6H_6 and H_2O, in which their mol. wts. are normal. The distribution between C_6H_6 and aq. $NaClO_4$, NaBr, KBr, KCl, KNO₃, and K₂SO₄ is also studied; the salting-out effect for CNBr in these solvents can be evaluated, as complex formation occurs only with Br′. CNI gives complexes (except with ClO₄′), and the following equilibrium consts. are deduced : [CNIBr′]/[CNI][Br′] = 0·65; [CNICl′]/[CNI][Cl′] = 0·39; [CNI·NO₃′]/[CNI][NO₃′] = 0·14. The structure of the CN halides is discussed; the differences in their properties are due to variations in the position of the electron-pair between the halogen and CN. The prep. and purification of CNI are described.
A. J. E. W.

Dynamics of sorption. A. A. SHUCHOVITZKI, J. L. ZABESHINSKI, and D. S. SOMINSKI (J. Phys. Chem. Russ., 1939, **13**, 303—310).—Mecklenburg and Kubelka's theory (Z. Elektrochem., 1925, **31**, 488) is invalidated by mathematical and other errors and has no physical basis. R. C.

Absorption of hydrogen by chromium. I. E. ADADUROV, N. I. PEVNI, I. I. RIVLIN, and G. P. KUSCHTA (Trudy Charkov Chim. Tech. Inst., 1939, No. 1, 12—18).—H_2 is not absorbed by Cr at ~800°. The catalytic activity (oxidation of NH_3) of 3 : 97 Cr-Pt is ≮ that of pure Pt, but the stability of the contact is considerably greater. The Cr-Pt lattice const. $a = 3.8845$ A., as compared with 3.9030 A. for pure Pt; after use, the val. of a rises to 3.9112 A., probably as a result of formation of CrN. R. T.

Sorption of gases on reduced nickel. II. Sorption of gaseous hydrogen bromide and hydrogen chloride and sorption of hydrogen bromide through a liquid medium. M. TAKE-BAYASHI (Bull. Chem. Soc. Japan, 1939, **14**, 290—294; cf. A., 1939, I, 253).—Data are recorded for the adsorption with time of HBr at 0° and of HCl at 0° and 20°. The equilibrium adsorption of both gases is greater at 20° than at 0°, and at either temp. the adsorption of HBr is > that of HCl. Adsorption of HBr from solution in CCl_4, corr. for concn., is slightly < from the gas. The presence of o-$C_6H_4(OH)_2$ (2 mg. per c.c.) increases the adsorption. F. L. U.

Adsorption of iodine vapour by powders. H. C. HAMAKER [with J. H. VAN DER VALK] (Rec. trav. chim., 1939, **58**, 903—916).—The adsorption of I by finely-powdered $BaCO_3 + SrCO_3$ (1 : 1 mixed crystals), $BaSO_4$, and Al_2O_3 has been investigated with a view to its use as a measure of particle-size. The effects of various treatments on the reproducibility of the results is described. The amount of I adsorbed increases on grinding in a ball mill, proportionally to the cube root of the time of grinding. F. J. G.

Electrolyte adsorption and activity coefficient. III. Adsorption of neutral salts. I. W. OSTWALD (Kolloid-Z., 1939, **88**, 144—161).—Data for the adsorption of neutral salts of valency type 1-1, 1-2, 1-4, 2-1, 3-1 on different varieties of C, on MnO_2 gel, and on Al_2O_3 conform to the relation previously established for acids (A., 1939, I, 366, 414). Departure from linearity is shown by salts which do not behave as strong electrolytes, e.g., CdI_2. The vals. of the consts. a and b in the equation $f_x = af_{c-x} + b$ afford a quant. measure of the adsorption activity of strong electrolytes, the most active [e.g., $Al(CNS)_3$ on C] being associated with large a and small b. F. L. U.

Adsorption of cis- and trans-azobenzene. H. FREUNDLICH and W. HELLER (J. Amer. Chem. Soc., 1939, **61**, 2228—2230).—The adsorption of cis- (I) and trans-azobenzene (II) at 20° on Al_2O_3 and on charcoal in MeOH and in ligroin has been investigated. (I) is adsorbed more strongly than (II) on Al_2O_3, markedly in ligroin and less so in MeOH. On the other hand, the (II) is adsorbed the more strongly on C, especially in MeOH. These results support the view that the more hydrophilic isomeride (I) will be more strongly adsorbed by the more strongly hydrophilic adsorbent (Al_2O_3), especially in the more hydrophobic medium (ligroin), and vice versa. Previous experimental data on the adsorption of maleic and fumaric acids on C in H_2O and of Me-violet on C and SiO_2 gel in H_2O and tetralin can also be explained on this view. Additional evidence that (I) is the more hydrophilic is its greater solubility in H_2O and MeOH and lower solubility in ligroin than (II). W. R. A.

Chemical specificity of those modifications of a particular crystalline species which differ in energy content. II. γ-Al_2O_3. R. FRICKE and H. DEIFEL. **III. ZnO and α-Fe_2O_3.** R. FRICKE and H. KEEFER (Ber., 1939, **72**, [B], 1568—1572, 1573—1576; cf. A., 1938, I, 532).—II. When specimens of γ-Al_2O_3 which have been dried under different conditions are shaken with aq. K_2HPO_4, the ratio ($K^{\cdot}$ adsorbed) : (HPO_4'' adsorbed) increases with increasing particle size, i.e., decreasing energy content.

III. When specimens of ZnO and of α-Fe_2O_3 which have been dried under different conditions are shaken with aq. KOAc, the ratio ($K^{\cdot}$ adsorbed) : (OAc' adsorbed) increases with decreasing energy content for ZnO, but decreases with decreasing energy content for α-Fe_2O_3. F. J. G.

Adsorption of hydrous metallic oxides by kieselguhr. E. C. C. BALY, W. P. PEPPER, and C. E. VERNON (Trans. Faraday Soc., 1939, **35**, 1165—1175).—The adsorption of Al_2O_3, CoO, and NiO from dil. colloidal solution by carefully purified kieselguhr (I) has been followed by measuring the ζ-potential corresponding with increasing amounts of adsorbate. The curves so obtained show a sharp max. of ζ at a point corresponding with a complete unimol. layer of oxide. The max. vals. of ζ are > those shown by the respective oxides, whence it is inferred that the adsorbate is activated owing to formation of adsorption complexes. NiO and CoO are each adsorbed in three layers together forming a single layer of cryst. unit cells; the outer surfaces of these adsorbates themselves adsorb 1 unimol. layer of H_2O. Calculations from the NiO and CoO experiments each give the same val., 2.869×10^6 sq. cm., for the effective surface of 100 g. of (I). When a mixture of composition $1ThO_2 : 24NiO$ (CoO) is adsorbed, one out of every seven groups of 4Ni (Co) + 4O atoms in each of the three layers of the cryst. lattice is displaced by 1 mol. of ThO_2. F. L. U.

Mechanical properties of monolayers of fatty acids, alcohols, and esters, and effect on them of acidity and cations of substrate. III. A. A. TRAPEZNIKOV (J. Phys. Chem. Russ., 1939, **13**, 406—416; cf. A., 1939, I, 196).—On pure H_2O a palmitic acid film remains of low η up to the point of destruction; the formation of tough films is caused by soap formation by cations in the substrate, this effect increasing with the valency of the cation. The various cations differ in the p_H region in which the film changes from slightly viscous to tough. The immediate effect of the p_H of the substrate on the mechanical properties of films of alcohols and esters is small compared with the effect of cations or of the p_H of the substrate in presence of cations on the properties of films of acid. On ascending a homologous series the film changes continuously from slightly viscous through highly viscous and plastic to elastic. The mechanical properties of films are influenced by the polar group as well as by the length of the chain. R. C.

Pressure-area and pressure-temperature relations of expanded monolayers of myristic and pentadecoic acids. G. C. NUTTING and W. D. HARKINS (J. Amer. Chem. Soc., 1939, 61, 2040—2046). —Pressure (f)–area (A) isotherms for monolayers of myristic acid (I) on $0.01N$-H_2SO_4 have been determined at 7 temp. between $6.7°$ and $25°$. The graphs show a marked curvature (expanded film), and a break towards high pressures which characterises the formation of an intermediate film. The $25°$ isotherm is displaced towards low vals. of f and A, owing to the solubility of (I) at the highest temp. in the H_2SO_4. Decrease in the rate of compression of the intermediate film causes an increase in A at a given f and an increase in f at a given A. At const. temp. an intermediate film undergoes a gradual transition into a condensed liquid film by increase of f. The film thus formed exhibits a linear f–A relation and, for pentadecoic acid (II) at $25°$, undergoes a sharp transition to a plastic solid film at 21.3 dynes per cm. and 20.52 sq. A. For any long straight chain mol., A for the transition liquid → solid is much more dependent on the pressure than on the material of the film. f–T measurements have been made on monolayers of (I) and (II) on $0.01N$-H_2SO_4 at const. vals. of A. The order of the slope $\partial f/\partial T$ is ~ 1.0 for the intermediate and ~ 0.2 for the expanded films.   W. R. A.

Films at the liquid/liquid interface. III. Specific effect of calcium ions on kephalin monolayers. A. E. ALEXANDER, T. TEORELL, and C. G. ÅBORG (Trans. Faraday Soc., 1939, 35, 1200—1205). —Force–area curves have been determined for kephalin (I) at the interface between C_6H_6 and aq. NaCl, KCl, NaOH, HCl ($0.1M$.), $MgCl_2$, $CaCl_2$ ($0.005M$.). $Ca^{..}$ ions exercise a sp. stabilising effect not shown by $Na^{.}$, $K^{.}$, or $Mg^{..}$, although a similar effect is obtained with NaOH and HCl. The effect is attributed to stabilisation of (I) in the interface preventing its dissolution in the C_6H_6 phase. At an air–H_2O interface $Ca^{..}$ causes slight condensation of the film and an increase of $30—40$ mv. in the surface potential.   F. L. U.

Experimental verification of O. Stern's theory of double layer. O. ESSIN and B. MARKOV (J. Phys. Chem. Russ., 1939, 13, 318—325).—In testing Stern's theory in so far as it relates the potential, e, to the adsorption potentials of the ions, the conditions should be such that complications are not introduced by the exchange of ions between metal and solution, e.g., the relation between e at the max. of the electrocapillary curve and the concn., c, of capillary-active ions in the solution may be examined. New data for the interface Hg/0.01—$3N$-KI and existing data agree with $e = \text{const.} - k \log_e (c/e)$, but the val. of k differs from that required by Stern's theory, probably as a result of the neglect by the theory of the interaction between the adsorbed ions parallel to the interface.   R. C.

Electro-capillary curves in non-aqueous solution. I. Capillary-active organic cations in methyl alcohol. A. MURTAZAEV and M. ABRAMOV (J. Phys. Chem. Russ., 1939, 13, 350—352).—The electro-capillary curves for solutions of NMe_4I, NEt_4I, $NHMe_3Cl$, and NH_4NO_3 in contact with Hg have been determined. The effect of the cations on the curve resembles that for aq. solutions.   R. C.

Influence of carbohydrate substances on interfacial tension between water and cyclohexane. J. B. MATTHEWS (Trans. Faraday Soc., 1939, 35, 1113—1122).—The change of interfacial tension (γ) with concn. has been measured for cyclohexane and aq. solutions of sugars, dextrins, pectins, gum arabic, glycogen, inulin, and starch. Equilibrium vals. were obtained for all but the last two. The shape of the $\Delta\gamma$–concn. curve depends on the type of film at the interface, and on the basis of the results it is inferred that glucose, lactose, sucrose, and gum arabic form gaseous films at all concns.; whilst dextrin gives a gaseous film which becomes condensed above a crit. concn. Citrus and apple pectins form films of an intermediate type.   F. L. U.

Stability and properties of aerosols. R. G. RUYSSEN (Natuurwetensch. Tijds., 1939, 21, 159—170).—A review.   S. C.

Nature of foam. VI. Emulsion and foam formation in the system ethyl alcohol–ethyl ether–water. T. SASAKI (Bull. Chem. Soc. Japan, 1939, 14, 250—258; cf. A., 1939, I, 368).—The mutual solubility curve, tie lines, and the foam stability of the system have been determined. The foam stability curve shows two max., one on the phase boundary between homo- and hetero-geneous regions and the other on the $EtOH$–H_2O side of the diagram. The heterogeneous region can be subdivided into three portions, the first two of which give H_2O-in-oil and oil-in-H_2O emulsions respectively however such mixtures are shaken. The third is a foam inversion region in which mixtures may give either type of emulsion according to the method of shaking.   T. H. G.

Interaction between two hydrophobic colloidal particles, using the approximate Debye–Hückel theory. I. General properties. S. LEVINE and G. P. DUBE. **II. Numerical computations of energy function.** G. P. DUBE and S. LEVINE (Trans. Faraday Soc., 1939, 35, 1125—1140, 1141—1156).—I. An alternative method, simpler than that previously given (cf. A., 1939, I, 416) for obtaining the interaction energy, is developed, and the physical meaning of the various terms in the expression is explained. The results obtained by Langmuir (A., 1939, I, 873) and by Derjaguin (Acta Physicochim. U.R.S.S., 1939, 10, 333), so far as they bear on this problem, are held to be incorrect. It is pointed out that Debye and Hückel, in developing their theory, omitted a term which, whilst negligible for dil. solutions, is important at high concns.

II. The interaction energy is calc. to the third approximation for both metallic and insulating particles. The results are discussed.   F. L. U.

London–van der Waals force between two particles in the form of discs. G. P. DUBE and H. K. DASGUPTA (Compt. rend., 1939, 209, 340—342; cf. A., 1938, I, 14).—Expressions are derived for the interaction energy of two disc-shaped colloidal particles, (a) with the discs in the same plane, and (b) with a common perpendicular line of centres.   A. J. E. W.

Structure and properties of highly purified reduction gold sols. W. PAULI, J. [SZPER], and S. SZPER (Trans. Faraday Soc., 1939, **35**, 1178—1183).—The prep. of red Au sols in quantities of 1500 c.c. by reduction of slightly alkaline $HAuCl_4$ with EtOH at 60° is described. The sols can be purified and conc. by electrodecantation to >5% or >0·1% when the " Gegenionen " are K˙ or H˙ respectively. Analysis of the sols and of the liquid obtained by freezing coagulation shows that the stabilising ionogenic groups are Au–Cl complexes which can partly hydrolyse to mixed Cl–OH complexes, in agreement with the results obtained with Au sols of other types (cf. A., 1932, 225).   F. L. U.

Composition of the colloidal platinum micelle. S. W. PENNYCUIK (J. Amer. Chem. Soc., 1939, **61**, 2234—2237).—Pt sols were prepared by the Bredig method and particles were isolated by coagulating the sol by freezing and subsequent thawing. From analyses by microchemical methods the composition of the average micelle is $[3·9Pt,1·16PtO_2,1·0H_2Pt(OH)_6]_n$. All the H_2O in the micelle is contained in the self-formed stabilising $PtO_2,4H_2O$ [$\equiv H_2Pt(OH)_6$] (I). The total amount of (I) is 27·2% of the gross wt. and the greater part of it is combined in the micelle, where it remains even after prolonged boiling. On ageing the ppt. formed is less rich in stabilising material than the ordinary micelle. The residue in the Bredig vessel is light grey and nearly pure Pt.   W. R. A.

Stability of silver iodide sols in presence of gelatin. I. R. PROTAS (J. Phys. Chem. Russ., 1939, **13**, 446—450).—The stability has been studied by turbidity measurements. It is increased by gelatin if the p_H is such that the charge of the gelatin has the same sign as that of the sol, and vice versa. The effect of KNO_3, $Ba(NO_3)_2$, and $Th(NO_3)_4$ on positive sols seems to consist in consolidation of the diffuse part of the double layer by the NO_3' ions and withdrawal from it of anions under the influence of cations, an effect which increases with the valency of the cations.   R. C.

Colloidal solution of chalcedony. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 64—68; Chem. Zentr., 1937, i, 1388).—An electronegative colloidal solution with a weakly acid reaction, containing 0·126 g. of SiO_2 per 100 c.c., is prepared by heating powdered chalcedony with H_2O at 180—185° for 100 hr. in a Pt-lined tube. The solution is coagulated by aq. HCl, $ZnCl_2$, or NH_4Cl, but not by EtOH or aq. NH_3.   A. J. E. W.

Behaviour of some mixed colloids at high temperature. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 69—74; Chem. Zentr., 1937, i, 1388—1389).—Evaporation of a mixture of similarly charged hydrosols after heating at 200° gives the unchanged solid phases. A mixture of oppositely charged calcite and chalcedony (I) sols yields (I) and aragonite (II) on similar treatment. (II) is also formed in absence of (I), but the presence of CO_2, which forms $Ca(HCO_3)_2$ as an intermediate, is essential.   A. J. E. W.

Colloidal solution of fluorspar. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 187—192; Chem. Zentr., 1937, i, 1389).—A slightly acid solution containing 29·6 p.p.m. of CaF_2, which exhibits Brownian movement, is obtained by heating finely-powdered fluorspar with H_2O at 206—210° for 52 hr. in a Pt-lined tube. The solution is coagulated by EtOH and aq. NH_3, but not by HCl, NH_4Cl, or $BaCl_2$, and is thus electropositive.   A. J. E. W.

Disperse structure of solid systems and its thermodynamic basis. D. BALAREV [with N. KOLAROV] (Kolloid-Z., 1939, **88**, 161—171).—The reversibility of structural changes in crystals is shown by a study of the heating curves of $CaCO_3$ and $BaCO_3$, and by the behaviour of $CaCO_3$ and $BaSO_4$ containing Th-X (" emanation method "). The observations afford additional support for the author's theories (cf. A., 1934, 148; 1939, I, 195, 369).   F. L. U.

Diffusion of an aggregating electrolyte in the transition range from simple to colloidal solution. G. S. HARTLEY (Trans. Faraday Soc., 1939, **35**, 1109—1113).—The existence of a min. diffusion velocity for a colloidal electrolyte in the transition range, reported by McBain (A., 1939, I, 369), is accounted for theoretically on the assumption that only one kind (*i.e.*, charged) of micelle is present.
    F. L. U.

Influence of ultrasonic waves on colloid phenomena. VI. Influence of ultrasonics on rotatory power of high-molecular colloid substances. II. Experiments with tannin solutions. N. SATA (Kolloid-Z., 1939, **88**, 182—184; cf. A., 1939, I, 369).—Aq. solutions of tannin darken considerably and may become turbid when subjected to ultrasonic vibrations. This change is due to dissolved air and is not observed either in aq. solutions in a vac. or in EtOH solutions. In no case is the rotatory power affected.   F. L. U.

Ageing phenomena and molecular dimensions of chain complexes in solution. [I.] W. WEHR (Kolloid-Z., 1939, **88**, 185—208).—The influence of various factors on the ageing of cellulose nitrate (I) and acetate, benzylcellulose, polymerised hydrocarbons and chlorinated hydrocarbons, and polyvinyl acetate has been studied, chiefly by measurements of η. The changes observed are associated with shortening of the chains due to hydrolysis or oxidation. Breakdown is accelerated by peroxides (Bz_2O_2) and retarded by antioxidants. Saturated synthetic polymerides and chlorinated or vulcanised rubber are relatively stable, whilst in the other classes the strength of films is substantially diminished by ageing the parent solutions. Determinations of the mol. size of (I) and cellulose products are described and discussed.
    F. L. U.

Macromolecular compounds. CCXX. Dissociation of multivalent macromolecular acids. W. KERN (Biochem. Z., 1939, **301**, 338—356).—An extension of the Michaelis dissociation equation to multivalent macromol. acids leads to the expression $\alpha' = 1/[1 + (h/k_m')^{1-A}]$ where h = H˙ activity, 1 — A = titration exponent, k_m' = average titration (dissociation) const., and α' = degree of titration (dissociation) (cf. A., 1938, I, 512). Potentiometric data obtained for aq. solutions of synthetic polyacrylic and polymethacrylic acids have been successfully applied

to the expression. Calculations from published data on natural macromol. acids also lead to vals. agreeing with the expression. The val. of $1 - A$ depends on the distance between the dissociating groups in the macromol. If the groups are well separated the influence is small and the acid behaves as a monobasic acid. The least vals. for $1 - A$ were obtained for polynucleic and agaric acids and the highest vals. for the synthetic and gum arabic acids. C. R. H.

Action of ammonia on collodions. J. GRÉVY (Compt. rend., 1939, **209**, 304—306).—The increase and subsequent decrease of η for EtOH–Et_2O solutions of cellulose nitrate (I) containing NH_3 (cf. A., 1932, 1202) is accompanied by partial denitration of the (I) and formation of NH_4NO_2 and NH_4NO_3. Conc. (4%) unstabilised collodions show a decrease of η (35% in the first week) on keeping in the absence of NH_3. The η max. is reached more rapidly after addition of NH_3, and becomes less marked on keeping the collodion. The effects are very small with low (I) concns. (0·4—0·8%). A close relation exists between the effect of NH_3 and the state of dispersion. Stabilised collodions do not show the initial increase of η on addition of NH_3, but effects analogous to the above are observed with C_6H_6 solutions of rubber. A. J. E. W.

Pasting of starch. V. Determination of heat of pasting. A. KÜNTZEL and K. DOEHNER (Kolloid-Z., 1939, **88**, 209—215; cf. A., 1939, I, 141).—The total heat of pasting is made up of the heats of hydration (swelling) of dry starch (q_1) and pasted starch (q_2), the heat of deformation (q_3) and heat of fusion (q_4). These have been determined calorimetrically as follows: q_1 —17·47, q_2 —2·6, $q_3 + q_4$ 39·35 g.-cal. per g. of dry potato starch. q_3 and q_4 cannot be measured separately. F. L. U.

Theory of force–extension diagram of hydrous cellulose and its experimental examination. P. H. HERMANS (Kolloid-Z., 1939, **88**, 172—182).—Additional formulæ are deduced (cf. A., 1938, I, 311; 1939, I, 141) and shown to agree with experimental data. F. L. U.

Wild silks. IV. Viscosity concentration constant of fibroin sols. S. BITO (Bull. Sericult. Japan, 1939, **11**, 146—148).—For fibroin sols in Loewe's reagent, the vals. of K (= $\log_e \eta/C$, where η = relative viscosity and C = concn.) for *Bombyx*, yamamai, tussah, and kuriwata silks are 0·3631, 0·2862, 0·2598, and 0·2023, respectively. F. O. H.

Solubility of crystalline pepsin.—See A., 1939, III, 871.

Influence of an alternating electric field on rate of coagulation. I. Negative silver iodide sols. II. Sols of tungstic acid. J. J. HERMANS (Rec. trav. chim., 1939, **58**, 725—740, 741—750).—I. The initial rate of coagulation of negative AgI sols in presence of KNO_3 is increased by an alternating electric field, the relative increase being greatest at low [KNO_3]. The effect is similar to that of a sonic field (A., 1939, I, 197). The increase in rate $\propto$ approx. the fourth power of the field strength but is independent of the frequency between 50 and 400 sec.$^{-1}$. Possible interpretations are discussed, and it is con-

cluded that distortion of the electrical double layer plays an important part.

II. Once the max. slope has been attained, the turbidity–time curves for mixtures of Na_2WO_4 and excess of HCl follow the normal course of coagulation curves. A study of the effect of an alternating electric field on this coagulation is impracticable because of the heat developed. If the reagents are in equimol. proportions a sol results which is coagulated normally by $BaCl_2$. The initial rate of this coagulation is decreased by an alternating electric field, and if the field is applied after coagulation has proceeded for some time, the turbidity diminishes sharply to a min. and then increases at a rate corresponding with the applied field. F. J. G.

Influence of ionic strength and p_H on electrophoretic mobility. B. D. DAVIS and E. J. COHN (J. Amer. Chem. Soc., 1939, **61**, 2092—2098).—The electrophoretic mobility (v) of carboxyhæmoglobin has been studied at 25° in phosphate and citrate buffers (p_H 5·65—7·2, ionic strength 0·02—0·20). v is extremely sensitive to p_H, ionic strength, and the valency and nature of the ions present. Corrections for the influence of electrostatic forces both in diminishing v and in changing the isoelectric point are considered. Computations attempted on the basis of these results yield consts. for the effect of the buffers at const. p_H and at const. p_H intervals from the isoelectric condition. Both v and the diminution in v due to electrostatic forces are a function of the net charge and increase with distance from the isoelectric condition. W. R. A.

Electrical conductivity of molten system KCl–$MgCl_2$ in region of possible existence of compound $2KCl,MgCl_2$. A. SCHTSCHERBAKOV and B. MARKOV (J. Phys. Chem. Russ., 1939, **13**, 353—355).—The conductivity of mixtures containing 27—37 mol.-% $MgCl_2$ indicates the existence of the compound. With rising temp. the equilibrium $MgCl_4'' \rightleftharpoons MgCl_2 + 2Cl'$ shifts towards the right. R. C.

Connexion between complex formation and oxidation–reduction reactions. II. Reactions of cupric salts with aromatic redox systems. L. KULBERG (J. Gen. Chem. Russ., 1939, **9**, 663—670).—The expression $L_p = 10^{-(E_1 - E_2)/0·058}$ is derived (L_p is the solubility coeff. of a complex salt of Cu^{II} with org. bases, and E_1 and E_2 are the oxidation potentials of the base and of the system $Cu^{II} \rightleftharpoons Cu^{I}$, respectively), and verified for complex salts of benzidine, tolidine, m- and p-$C_6H_4(NH_2)_2$, and $1:2:5$-$C_6H_3Me(NH_2)_2$ with $CuSO_4$. The complex salts are stable in presence of halides when their L_p is $<$ that of CuX (X = Cl, Br, I, CNS); in accordance with this rule quinol and pyrogallol do not yield complexes with $CuSO_4$. R. T.

Acid–basic indicators in solvents with different acid–basic properties. A. I. SCHATTENSTEIN (J. Phys. Chem. Russ., 1939, **13**, 366—377).—To examine the relation between indicator equilibrium and the acid–basic properties of the indicator and solvent the colours exhibited by several indicators in various types of solvent and the effect of adding acids and bases have been observed. Phenomena sp. to

this equilibrium can be observed in absence of protons. It seems that some of the substances studied, which play the part of acids, owe this property to their being able to saturate the free pair of electrons of bases.　　　　　　　　　　　　　　　　R. C.

Differentiating action of solvents on the strength of acids. II. Separate potentiometric titration of mixtures of acids with high dissociation coefficients, in differentiating solvents. N. A. IZMAILOV, M. B. SCHUSTOVA, and N. VODOREZ (J. Gen. Chem. Russ., 1939, **9**, 598—605).—The val. of the dissociation coeff. of $CCl_3 \cdot CO_2H$ in various solvents falls in the order $H_2O \gg EtOH > 1 : 1$ $EtOH-C_6H_6 > 1 : 3$ $EtOH-C_6H_6 = 1 : 1$ $COMe_2-PhNO_2 > 1 : 3$ $COMe_2-PhNO_2 > 1 : 1$ $COMe_2-CHCl_3 > COMe_2 > 1 : 1$ $COMe_2-C_6H_6 > 3 : 1$ $COMe_2-C_6H_6 = 1 : 3$ $COMe_2-CHCl_3 > 1 : 3$ $COMe_2-$ $PhMe > 1 : 1$ $COMePr-PhMe > COMeEt > 1 : 1$ $COMe_2-PhMe = 3 : 1$ $COMe_2-PhMe = 1 : 1$ $COMeEt-$ $PhMe > COMePr$. Analogous results are obtained for $CHCl_2 \cdot CO_2H$ and $CH_2Cl \cdot CO_2H$. In differentiating solvents HCl and the above acids behave as mixtures of strong and weak acids, permitting their separate potentiometric titration.　　　R. T.

Electrostatic effect of substituents on dissociation constants of organic acids. IV. Aromatic acids. F. H. WESTHEIMER (J. Amer. Chem. Soc., 1939, **61**, 1977—1980; cf. A., 1939, I, 263).—The electrostatic effect of substituents (Me, F, Cl, Br, CN, NO_2, OH, OMe) on the dissociation consts. of p-substituted phenylacetic and benzoic acids, phenols, and anilines, computed according to Kirkwood and Westheimer (cf. A., 1938, I, 574), is the important factor in determining the strength of the carboxylic acids with the exception of p-hydroxy- and p-methoxy-benzoic acids. This effect also contributes, to a smaller extent, to the variation of acidity among substituted phenols and anilinium ions; the latter are considered as acids according to the Brönsted definition. The greatest difference between the total and electrostatic effects of a substituent is observed for compounds in which resonance interaction of the groups is indicated from dipole moment data.
　　　　　　　　　　　　　　　　W. R. A.

Activity coefficients of barium and strontium carbonates in aqueous solutions of alkali chlorides. E. HOGGE and H. L. JOHNSTON (J. Amer. Chem. Soc., 1939, **61**, 2154—2156).—The mean activity coeffs. of $BaCO_3$ and $SrCO_3$ in aq. solutions of the alkali chlorides, determined by Townley et al. (A., 1937, I, 298), have been recomputed with corrections for the improper evaluations of the mean mobilities, misinterpretation of the data of MacInnes and Belcher (A., 1935, 1321), and differences in the degree of H_2CO_3 dissociation in the alkali halides. The corr. data are recorded for 25° and 40°.　W. R. A.

Vapour–liquid equilibrium in the system propane-*iso*butylene. H. W. SCHEELINE and E. R. GILLILAND (Ind. Eng. Chem., 1939, **31**, 1050—1057).— Data on the v.p. of C_3H_8, $CMe_2:CH_2$, and mixtures thereof at 200—600 lb. per sq. in. are presented. Differences occur, especially in the crit. regions, between the observed vals. and those calc. from Lewis'

fugacity equation. A method of obtaining an approx. general correlation of vals. of K (= ratio of mol. fraction of component in vapour and liquid phases respectively) in the crit. region is suggested. Accepting the accuracy of the fugacity rule at low pressures and given accurate knowledge of the crit. data for mixtures, it is only necessary to estimate the temp. and pressure at which K for the heavier component passes through min.; complete curves, sufficiently accurate for engineering purposes, can then be sketched in. A glass apparatus which enables equilibrium data to be determined rapidly at high pressures is described.
　　　　　　　　　　　　　　　　C. R. H.

Vapour pressures of solutions of hypochlorous acid at 10° and 20°. J. OURISSON and M. KASTNER (Bull. Soc. chim., 1939, [v], **6**, 1307—1311).—The composition of the vapour in equilibrium with aq. HOCl at 10° and 20° has been determined by a dynamic method. The vapour contains HOCl as well as Cl_2O. In the expressions $p_{Cl_2O} = K_1[HOCl]^2$ and $p_{HOCl} = K_2[HOCl]$, K_1 and K_2 are 0·21 and 0·24 at 10°, and 0·65 and 0·70 at 20°, respectively, with p in mm. of Hg.　　　　　　　　　　F. J. G.

Physical studies of non-aqueous solvates. III. Vapour pressure of zinc bromide–diethyl ether solutions. H. H. ROWLEY and F. V. OLSON (J. Amer. Chem. Soc., 1939, **61**, 1949—1952; cf. A., 1937, I, 308).—The v.p. of saturated $ZnBr_2-Et_2O$ solutions has been measured from $-10°$ to 35°. The curve log v.p.–$1/T$ shows three distinct slopes which change at between 0° and 5° and at 20°, indicating three distinct solid phases. Analyses of the wet solids in equilibrium with saturated solution indicate $ZnBr_2,2Et_2O$ (I), $ZnBr_2,Et_2O$ (II), and $ZnBr_2$ (III). (I), in equilibrium with the saturated solution at 0°, crystallises in transparent plates; these disappear between 0° and 5°, and at 15° the solid (II) in equilibrium is composed of transparent needles; at 25° the equilibrium solid (III) is opaque and finely divided with no cryst. shape. Possible sources of error are indicated in the work of Raynaud (A., 1926, 486) which is in disagreement with the present data.
　　　　　　　　　　　　　　　　W. R. A.

Thermal conductivity of the system H_2–HCl and equilibrium in the reduction of cuprous chloride by hydrogen. F. ISHIKAWA and N. IMAMURA (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 537–547).—The thermal conductivity of the system H_2–HCl has been measured at 25° and at 300, 500, and 700 mm. Hg. The results are used to study the equilibrium in the reduction of CuCl by H_2 at 300 mm. and from 290° to 400°.　　　D. F. R.

Dehydration of manganous sulphate by the aqueous method. Intermediate hydrates. R. ROHMER (Compt. rend., 1939, **209**, 315—317).— Dehydration of $MnSO_4,7H_2O$ in contact with its aq. solution (cf. A., 1939, I, 420) shows the existence of further hydrates with 5, 4, 2, and $1H_2O$; the solubility and d vals. for the congruent solutions at 31°, 34°, 38°, and 42° are recorded. Invariant systems containing $MnSO_4,5H_2O$ and $MnSO_4,4, 2,$ or $1H_2O$ as solid phases occur at 27·5°, 26·1°, and 23·9°, respectively. The di- and tetra-hydrates are metastable.
　　　　　　　　　　　　　　　　A. J. E. W.

System HgCl₂–HgBr₂. P. G. MEERMAN and W. SCHOLTEN (Rec. trav. chim., 1939, **58**, 800—804).—The β phase, reported by van Nest (A., 1910, ii, 295) but not found by van Pelt and de Boer (A., 1935, 35), exists between ~50 and 60 mol.-% $HgCl_2$. With rise of temp. it is transformed into the α phase, isomorphous with $HgCl_2$.   F. J. G.

Phase equilibrium relations in the system, Na₂SiO₃–Li₂SiO₃. F. C. KRACEK (J. Amer. Chem. Soc., 1939, **61**, 2157—2161).—Within the ternary system, $Na_2O–Li_2O–SiO_2$, there exists the binary system, $Na_2SiO_3–Li_2SiO_3$, which forms an intermediate compound $NaLiSiO_3$ (incongruent m.p. $847 \pm 1°$). The liquidus has two branches. The primary phases in equilibrium with liquid are two series of solid solutions. Vals. of n_D of the glasses and crystals in quenched samples have been measured.   W. R. A.

Reversible pairs of salts.—See B., 1939, 936.

Equilibrium between oxygen and titanium in iron melts. H. WENTRUP and G. HIEBER (Arch. Eisenhüttenw., 1939—40, **13**, 69—72).—Addition of Ti to Fe reduces the free O_2 content from 0·02% to a const. val. of 0·005% at ~1% Ti; the deoxidising capacity of Ti is thus > that of Si, and < that of Al. The chief compound formed appears to be $FeTiO_3$ (ilmenite). From these and other published results (A., I, 1938, 448; 1939, I, 322) a phase-rule diagram for the system $Fe–FeO–FeTiO_3–Ti_2O_3–Fe_2Ti$ is constructed.   R. C. M.

Systems copper–zinc–sulphur and lead sulphide–cuprous sulphide–zinc sulphide. E. STROHFELDT (Metall u. Erz, 1936, **33**, 561—572; Chem. Zentr., 1937, i, 1525).—The related binary systems are discussed. Analytical and microscopical data for the system Cu–Zn–S show that the melt forms an upper $Cu_2S–ZnS$ layer in equilibrium with a Cu–Zn alloy containing ~1% of S; this S occurs preferentially as ZnS, the concn. of which increases with the Zn content of the system. Cu–Zn alloys absorb ≯1% of S, which separates from the melt as dendritic ZnS or a ZnS–mixed crystal eutectic. Cu_2S and ZnS do not absorb S. The system PbS–Cu_2S–ZnS deposits ZnS or PbS (according to composition) from the melt, but never Cu_2S. A PbS–Cu_2S eutectic occurs, but there is no ternary eutectic.   A. J. E. W.

Ternary systems KBrO₃–KClO₃–H₂O at 25° and NaBrO₃–NaClO₃–H₂O at 25° and 50°. T. SWENSON and J. E. RICCI (J. Amer. Chem. Soc., 1939, **61**, 1974—1977).—In the $KBrO_3–KClO_3–H_2O$ system the two salts dissolve in each other forming solid solutions with ≯3% $KClO_3$ in $KBrO_3$ and ≯5% $KBrO_3$ in $KClO_3$. The other system gives a solubility curve at 25° corresponding with the solid phases (*a*) pure $NaBrO_3$, (*b*) $NaBrO_3$ solid solution containing up to 5—10% $NaClO_3$, and (*c*) $NaClO_3$ solid solution containing up to 60—65% $NaBrO_3$. The iodometric determination of BrO_3' in presence of excess of ClO_3' is discussed.   W. R. A.

System zinc acetate–hydrogen chloride–acetic acid. A. W. DAVIDSON and W. CHAPPELL (J. Amer. Chem. Soc., 1939, **61**, 2164—2167).—F.p. data are recorded for anhyd. $ZnCl_2$–AcOH solutions of various concns. prepared by passing dry HCl over dry $Zn(OAc)_2$. In the ternary system $ZnCl_2$–HCl–AcOH, an additive compound of $ZnCl_2$ and HCl is indicated from f.p. data. In the ternary system $ZnCl_2$–$Zn(OAc)_2$–AcOH at 30° two double *salts*, $Zn(OAc)Cl$ and $Zn(OAc)Cl,ZnCl_2$, have been isolated.   W. R. A.

Physico-chemical analysis of reactions of organic amides with acids. I. Reaction of carbamide with fatty acids. A. G. BERGMAN and M. N. KUZNETZOVA. **II. Thermal analysis of the ternary system carbamide–acetic acid–water.** M. N. KUZNETZOVA and A. G. BERGMAN (J. Gen. Chem. Russ., 1939, **9**, 631—636, 637—641).—I. $CO(NH_2)_2$ (I) affords 1 : 1 *compounds* with HCO_2H, m.p. $-11·2°$, with AcOH (I), m.p. 39°, and with $EtCO_2H$, transition point 22·6°. C_4—C_{10} acids give homogeneous systems, without compound formation. The system lauric acid–(I) presents regions of stratification. (I) is insol. in molten palmitic or stearic acid.

II. The phase diagram consists of the two ternary systems AcOH–(II)–H_2O, eutectic at $-28·5°$, and (I)–(II)–H_2O, eutectic at $-22°$.   R. T.

System K₂O–N₂O₅–HCl–H₂O. Solubility isotherms. D. A. EPSCHTEIN and Z. N. KOSTERINA (J. Gen. Chem. Russ., 1939, **9**, 625—627).—The quotient $[Cl']/[NO_3']$ falls in solutions of K salts in HCl–HNO_3 with (i) rising $[H']$, (ii) rising temp., from $-20°$ to 21·5°.   R. T.

Heat of formation and specific heat of calcium nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 548—557).—From the determination of the sp. heat of Ca_3N_2 from 0° to 500° and measurement of the dissociation pressure at high temp., a val. of 108·2 kg.-cal. has been obtained for the heat of formation.   D. F. R.

Heats of formation of the oxides of manganese. H. SIEMONSEN (Z. Elektrochem., 1939, **45**, 637—643).—From calorimetric determinations of the heat changes accompanying the reactions $3Mn + 2O_2 = Mn_3O_4$, $3MnO + 0·5O_2 = Mn_3O_4$, $3Mn_2O_3 = 2Mn_3O_4 + 0·5O_2$, and $3MnO_2 = Mn_3O_4 + O_2$, the following heats of formation of the oxides are calc. : MnO 93·1$\pm$0·3, Mn_3O_4 336·5$\pm$0·2, Mn_2O_3 232·7$\pm$0·3, and MnO_2 125·4$\pm$1·0 kg.-cal. per g.-mol. The entropy changes accompanying the synthesis of the oxides are 14·4$\pm$0·6, 35·5$\pm$0·7, 24·7$\pm$1·0, and 13·9$\pm$0·4 entropy units per g.-mol., respectively.   J. W. S.

[Heat of combustion of succinic acid.] W. A. ROTH (Union Internationale de Chimie, Permanent Committee on Thermochemistry, Second Appendix to First Report, 1939, 1—4).—The heat of combustion of succinic acid (I) in a vac., referred to the standard val. of 6319·0 g.-cal. per g.-mol. for BzOH at 20°, is 3025·5 g.-cal. per. g.-mol. at 20°. Vals. are recorded for the heats of combustion of (I) and the ratio of the heats of combustion of (I) and of BzOH at each degree between 15° and 30°.   J. W. S.

Resistance of the surface of contact between antimony and cadmium. S. HOLMQVIST (IVA, 1936, 109—118; Chem. Zentr., 1937, i, 1896).—The

temp. coeff. of the resistance of the interface (R) is -0.02 at room temp., and -0.036 at $-150°$. R is raised by preheating at $200°$, the effect increasing with the time of heating. The resistant layer is 0.008 mm. thick, and its sp. resistance (referred to a conductor 1 m. long and 1 sq. mm. in cross-section) is 10^5—2×10^7 Ω. at $0°$ to $-180°$.   A. J. E. W.

Dependence of conductance on field strength. I. Tetrabutylammonium picrate in diphenyl ether at 50°. D. J. MEAD and R. M. FUOSS (J. Amer. Chem. Soc., 1939, **61**, 2047—2053).—The conductivity of NBu₄ picrate in Ph_2O (10^{-3} to 10^{-6} N.) at $50°$ has been measured at low voltages and 1000 cycles and at 60 cycles with field strengths up to 15 kv. per cm. The activity coeffs., determined from the conductivity–field strength curves, are in approx. agreement with the vals. calc. by the limiting Debye–Hückel law, and thus the existence of an ionic atm. in a solvent of low dielectric const. is demonstrated. At low concns. an increase of 1.6% per kv. is found, in fair agreement with the theoretical val., 1.32%, calc. by Onsager's theory, and therefore the existence of ionic association is proved.   W. R. A.

Conductivity of aqueous solutions of the difficultly soluble hydroxides $Be(OH)_2$, $Mg(OH)_2$, $Zn(OH)_2$, $Cd(OH)_2$, and $Hg(OH)_2$. M. HŁASKO and A. SALITÓWNA (Rocz. Chem., 1939, **19**, 396—408). —Conductivity coeffs. are given for dil. solutions of Be, Zn, Cd, and Hg^{II} hydroxides, at $25°$. The transport nos. of the ions of this group rise in the order Be < Zn < Cd < Mg < Ca < Sr < Hg^{II} < Ba, and the conductivity coeffs. in the order Be < Zn < Cd < Hg^{II} < Mg < Ca < Sr < Ba.   R. T.

Potential of a chromium electrode, and its dependence on the acidity of the solution. V. ČUPR and K. MAREK (Chem. Listy, 1939, **33**, 233—236, 257—260).—A passivated Cr electrode ($K_2Cr_2O_7$ in H_2SO_4) undergoes self-activation in aq. acids, the potential–time curve consisting of three chief branches, corresponding with the passive state, a stage of transition from the passive to the active state, and with dissolution of Cr, respectively. The results obtained with different concns. of different acids (HCl, H_2SO_4, $HClO_4$) are explained on the basis of W. J. Müller's theory of the passive state. R. T.

Theory of the electrochemical poly-electrode systems and its application to corrosion problems. II. Potentials of three- and many-electrode systems. N. D. TOMASCHOW (Korros. u. Metallschutz, 1939, **15**, 157—168; cf. A., 1937, I, 245). —The theory is exemplified by a study of the three-electrode system Zn–Cd–Pt. The Cd electrode shows anodic, neutral, or cathodic behaviour according as its own potential is more negative than, the same as, or more positive than that of its point of contact in the two-electrode system, and accordingly all factors which influence the potentials of the two working electrodes affect the behaviour of the intermediate electrode. The effects of various factors (c.d., depolarisers, etc.) on the behaviour of the intermediate electrodes in the three-electrode system and in some many-electrode systems have been studied.   F. J. G.

Reduction–oxidation potential of the antimony electrode. Y. KAUKO and L. KNAPPSBERG (Suomen Kem., 1939, **12**, B, 17—18).—Measurements of $\partial E/\partial \log P_{O_2}$ with the Sb electrode show that it functions as a true O_2 electrode. E is independent of P_{H_2}. The dissociation pressures Sb_2O_3 $10^{-76.2}$ atm., Sb_2O_4 $10^{-24.5}$ atm., and Sb_2O_5 $10^{-5.2}$ atm. have been calc. In absence of O_2 Sb gives only Sb_2O_3 with H_2O, but may form higher oxides in presence of air.
          M. H. M. A.

Overvoltage of silver. A. T. VAHRAMIAN (J. Phys. Chem. Russ., 1939, **13**, 311—317; cf. A., 1939, I, 421).—When the current starts to pass, the cathodic potential, V, rises rapidly to a max., which is ascribed to the high c.d. on the growing points of the cathode, then falls towards a const. val., E', which is the smaller the higher is the electrolyte concn. In 0.1N-$AgNO_3$ E' rises with the current strength, but in 6N-$AgNO_3$ there is little change.   R. C.

Overvoltage of hydrogen on lead. B. KABANOV, S. FILIPPOV, L. VANJUKOVA, Z. IOFA, and A. PROKOFEEVA (J. Phys. Chem. Russ., 1939, **13**, 341—349).—The overvoltage, η, on bright very pure Pb in 0.01—8N-H_2SO_4 is > on all metals so far examined and does not vary with $[H_2SO_4]$; the literature vals. for η seem all to be incorrect, apparently owing to roughness of the electrode and to impurities. Adsorbed $PbSO_4$ on the electrode appears to promote the evolution of H, thus changing the slope of the η–c.d. curve (cf. A., 1933, 29); the process $2H^{\cdot} + 2\ominus + 0.5O_2 = H_2O$ has no such effect.   R. C.

Relation between temperature and current density at constant overvoltage and significance of change of potential at constant current density. V. SIHVONEN (Suomen Kem., 1939, **12**, B, 15—17).— For both salt melts and aq. solutions the variation of c.d. with temp. for const. overvoltage (η) is given by : $\log (c.d.) = K_1 e^{(-q + K_2 nF\eta)/RT}$, where q is the activation energy and K_1, K_2 are const. for a given cell. Usually $K_1 \propto C_I C_D$, where $C_I =$ concn. of the electrolyte and C_D that of the depolariser. In aq. solutions $K_2 = 0.5$, and in salt melts $K_2 = 1$. The effect of sudden change of potential on η is discussed.
          M. H. M. A.

Thermodynamic significance of polarographic half-wave potentials of simple metal ions at the dropping mercury electrode. J. J. LINGANE (J. Amer. Chem. Soc., 1939, **61**, 2099—2103).—Mathematical. In the electrodeposition of metal ions at the dropping Hg electrode, solubility of the reduced metal in Hg causes only concn. polarisation at the electrode. An equation has been derived relating the half-wave potential of a simple metal ion to the ordinary standard potential of the metal. The difference between these potentials is a function of the affinity of the metal for Hg, the solubility of the metal in Hg, and the kinetics of the diffusion processes in the solution and in the Hg drops. Experimental data show that the half-wave potential is shifted to more negative vals. as the ionic strength of the solution increases.
          W. R. A.

Electrical method of measuring the diffusion of salts. O. LAMM (Svensk Kem. Tidskr., 1939, **51**, 139—148).—The method suggested involves measure-

ments of the resistance between electrodes placed at the ends of the vertical diffusion column. Mathematical relationships for the interpretation of the results are derived. J. W. S.

Aerodynamics of reacting substances. H. BATEMAN (Proc. Nat. Acad. Sci., 1939, 25, 388—391).—Mathematical. W. R. A.

Conditions of inflammation of gaseous mixtures. XIV. Effect of admixtures of acetone on cold and hot flame of butane. V. I. AVRAMENKO and M. B. NEUMANN (J. Phys. Chem. Russ., 1939, 13, 356—365).—The rate of reaction of a mixture of $COMe_2$ and O_2 is $\propto p^3$, where p is the pressure of the mixture. The temp. coeff. varies with the experimental conditions. $COMe_2$ slightly widens the regions of the hot and cold flames of C_4H_{10} (cf. A., 1939, I, 205). $COMe_2$ shortens the period of induction of the cold flame according to the equation previously given, indicating that the mechanism is the same in both cases; the $COMe_2$ hinders the diffusion of the active centres to the wall, and so lengthens the reaction chains. The effect on the period of induction of the hot flame is similar to that of inert gases. It is inferred that ketones do not inhibit the oxidation of hydrocarbons. R. C.

Application of the nitric oxide method to the investigation of reaction chains in the decomposition of hydrocarbons. L. A. K. STAVELEY and C. N. HINSHELWOOD (Trans. Faraday Soc., 1939, 35, 845—849).—A summary of the authors' work on chain lengths in org. reactions as measured by the inhibition of the reactions by NO (cf. A., 1939, I, 30). F. R. G.

Decomposition of hydrocarbons induced by free radicals. F. O. RICE and O. L. POLLY (Trans. Faraday Soc., 1939, 35, 850—854).—Thermal decomp. of n-C_4H_{10} is promoted by small amounts of O_2 which produce chain reactions of up to several hundred links. The chain reactions are considered to be initiated by formation of free radicals and alternative schemes for their termination, depending on the nature of the reaction, are tabulated (cf. Rice and Herzfeld, A., 1934, 369). F. R. G.

Kinetics of the thermal decomposition of tetramethylmethane (neopentane). T. J. GRAY and M. W. TRAVERS (Trans. Faraday Soc., 1939, 35, 868—870).—Thermal decomp. of CMe_4 at 500—520° gives CH_4 at a rate which first diminishes and subsequently increases and is slowed down by packing the reaction tube. The crit. increment is 60 kg.-cal. It is concluded that, contrary to the case of C_2H_6 but in analogy with that of NMe_3, the primary decomp. involves the formation of Me. F. R. G.

Activation energies of reactions involving conjugated systems. M. G. EVANS (Trans. Faraday Soc., 1939, 35, 824—834).—Activation energies of diene association reactions are much lower than for reactions involving ring and diradical formation which require the same repulsive forces between C centres and similar heats of reaction. This is attributed to the mobile electrons giving a large resonance energy in the transition state. F. R. G.

Calculation of base rate constants from acid rate constants. S. H. MARON and V. K. LA MER (J. Amer. Chem. Soc., 1939, 61, 2018—2021). W. R. A.

Macromolecular compounds. CCXIX. Kinetics of chain polymerisation. VII. Thermal polymerisation of styrene in various solvents. G. V. SCHULZ, A. DINGLINGER, and E. HUSEMANN (Z. physikal. Chem., 1939, B, 43, 385—408).—Additional data for the polymerisation of styrene (I) in various hydrocarbons confirm, on the whole, earlier data and conclusions (cf. A., 1937, I, 86, 522 and subsequently). The increase in degree of polymerisation (P) with concn. of (I) does not exactly follow the rule $P \propto \sqrt{[(I)]}$ as stated earlier. The data agree well with the equation $v_A = k_1 c_{St}^2 + k_2 c_L c_{St}$ [v_A = velocity of primary or activation stage, c_{St} and c_L = mol. of (I) and solvent per l., respectively, k_1 and k_2 = reaction consts. in pure (I) and in solvent respectively]. The energy of activation and the reaction const. are the same with (I) or polystyrene as solvent, indicating that polymerisation is a first-order reaction. The mechanism of the activation and subsequent polymerisation stages is further discussed. C. R. H.

Kinetics of exchange reactions. I. n-Butyl bromide. L. J. LE ROUX and S. SUGDEN (J.C.S., 1939, 1279—1283).—The velocity of the exchange reaction between radioactive Br' ions and $Bu^a Br$ has been measured in aq. $COMe_2$ (90 vol.-%) at 0—65°. The reaction is bimol. and is not catalysed by acids or bases. The energy of activation is 18.87 ± 0.14 kg.-cal. per g.-mol., and the velocity of reaction is of the order predicted for a gaseous system on the collision hypothesis. J. W. S.

Influence of the structure of alcohols on the velocity of certain chemical processes. V. D. BOGATSKI (Chimia, 1936, 25—55).—HCl combines with $COMe_2$, at a velocity $\propto$ temp., to yield compounds decomposed by EtOH, but not by H_2O. The velocity of esterification of $CCl_3\cdot CO_2H$ with alcohols in $COMe_2$ solution falls in the order EtOH > $Bu^\gamma OH$ > $Pr^\beta OH$ at 12° and 15°, and in the order $Bu^\gamma OH$ > $Pr^\beta OH$ > EtOH at 56°. The difference in reactivity of alcohols is related to the behaviour of their OH group, which tends to be detached as a whole during esterification in the case of tert. alcohols, but to eliminate H only in the case of primary alcohols. This view is supported by the observations that the rate of evolution of H_2 from alcohols and Na or Mg falls in the order primary > sec. > tert. alcohol, and that the velocity of ester formation with Ac_2O in $COMe_2$ is approx. the same for primary and tert. alcohols. R. T.

Effect of solvents on kinetics. A. S. SELIVANOVA and J. K. SIRKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 45—49).—The kinetics of the hydrolysis of EtOAc in presence of NaOH have been investigated with H_2O to which variable quantities of MeOH, $(CH_2\cdot OH)_2$ (I) (20—40%), glycerol (II) (5—80%), erythritol (III) (10—20%), or mannitol (IV) (5—15%) were added. The velocity was determined at 15°, 25°, and 35°. The rate in a solution containing a polyhydric alcohol is < that in H_2O.

The equation $k = k_0G^{-c}$ (k is velocity coeff. in a solution having a concn. of alcoholic OH equal to c, k_0 is velocity coeff. in H_2O, G is const.) holds for (I), (II), and (III). In solutions containing (IV) or MeOH the rate of hydrolysis is also reduced but the same relationship does not hold. The Arrhenius equation is only approx. accurate for these mixed solvents. For the reaction in H_2O the energy of activation is ~11,200 g.-cal. whilst in a solvent containing a polyhydric alcohol it is ~11,800 g.-cal. The viscosities of the solutions were also determined. The viscosities of solutions of (I), (II), (III), and (IV) in H_2O are practically the same for all solutions which have the same [OH]. A. J. M.

Medium effects in the prototropy of ketones. Kinetics of the bromination of acetone and acetophenone in aqueous acetic acid. T. G. BONNER, D. P. EVANS, and H. B. WATSON (J.C.S., 1939, 1353—1356).—A kinetic study of the bromination of $COMe_2$ and $COPhMe$ in mixtures of H_2O and AcOH (0—90% AcOH) and catalysed by 0·5N-HCl or 0·147N-NaOAc indicates that the changes in velocity with varying [AcOH] are due to variations in both the E and PZ terms of the kinetic equation $k = PZe^{-E/RT}$. For both the acid- and base-catalysed reactions E and PZ each tend to fall and then rise again with increasing [AcOH]. For the base-catalysed reaction E varies almost linearly with PZ. J. W. S.

ortho-**Effect. IV. Kinetics of the formation of *o*-substituted phenyltrimethylammonium iodide in methyl-alcoholic solution.** D. P. EVANS, H. B. WATSON, and R. WILLIAMS. **V. Alkaline hydrolysis of ethyl anthranilate.** J. J. GORDON and H. B. WATSON (J.C.S., 1939, 1348—1353, 1364—1365; cf. A., 1937, I, 516).—IV. The velocities of reaction of MeI with *o*-substituted derivatives of $NPhMe_2$ have been measured at various temp. *o*-Ph, -OMe, -NO$_2$, -Cl, -Me, or -Ph groups cause an increase in both the E and PZ terms of the kinetic equation $k = PZe^{-E/RT}$, but *o*-F causes no change in PZ. The largest effects are observed with Me and Ph as substituents, and it is suggested that in the transition complex these groups become linked to the N by a H-bond. The smaller effects due to other groups are attributed to their interaction with the unshared electrons of the N without linkage formation. Such interaction would increase E by decreasing the electron availability of the N and increase PZ by imposing a charge on the reactive portion of the complex. Such interaction is impossible with the *o*-F-compound, since F cannot expand its valency group.

V. The alkaline hydrolysis of *m*- (I) and *o*-$NH_2 \cdot C_6H_4 \cdot CO_2Et$ (II) in 85% EtOH has been studied at various temp. E for the hydrolysis of (I) is slightly >, and P is almost the same as, for EtOBz. For (II), E is the same as for *p*-$NH_2 \cdot C_6H_4 \cdot CO_2Et$, but P is high. It is inferred that in (II) chelation between the NH_2 and CO_2Et sets up a demand on the electrons of the N which causes the electromeric effect so to operate that the loss of negative charge by the reactive part of the complex is more than counteracted. J. W. S.

Carbonium ions and the hydrolysis of alkyl halides. R. A. OGG, jun. (J. Amer. Chem. Soc., 1939, 61, 1946—1949).—The dissociation of a Me halide in aq. solution into a Me ion with an open sextet (incomplete valency shell) and a halide ion is endothermic by >50 kg.-cal. per mol., whilst the reaction with H_2O to give a halide ion and the co-ordinated ion $MeOH_2^+$ is approx. thermo-neutral. Experimental data for Me halide hydrolysis favour the Olson–Halford mechanism ($MeOH_2^+$) rather than that of Hughes and Ingold (Me^+). The rôle of carbonium ions with an open sextet in org. reactions is probably negligible. W. R. A.

Formation of aryltrimethylammonium iodides in methyl-alcoholic solution. D. P. EVANS, H. B. WATSON, and R. WILLIAMS (J.C.S., 1939, 1345—1348).—Measurements of the velocity of reaction between MeI and substituted $NPhMe_2$ in MeOH at 25° indicate that substituents (Me, OMe, OPh, Ph, F, or Cl) in the *p*- or *m*-positions influence the reaction velocity by changing the energy of activation (E), whilst the non-exponential (PZ) term of the Arrhenius equation remains almost const. Comparison with the results of Laidler (A., 1939, I, 31) and of Hawkins (J.C.S., 1922, 121, 1170) indicate that for a given solvent E is not greatly changed by replacing C_5H_5N by $NPhMe_2$ or by replacing C_2H_3Br by MeI, but the PZ term falls appreciably. The change in solvent from $PhNO_2$ to MeOH or EtOH causes increases in E and PZ. J. W. S.

Oxidation of ethyl disulphide by hypobromite ion. Rate of the reaction. H. A. YOUNG and M. B. YOUNG (J. Amer. Chem. Soc., 1939, 61, 1955—1959).—The oxidation of Et_2S_2 in CCl_4 solution by OBr′ ions (aq. NaOBr) follows at least two independent courses with the production of Et sulphonate and SO_4'' ions respectively. No evidence was obtained for the formation of a sulphenic acid according to $Et_2S_2 + H_2O = EtSH + EtSOH$. The rate of the oxidation at 25° follows the law $-d[OBr']/dt = k[Et_2S_2][OBr']/[OH']$, where $k = 0·028 \pm 0·002$. W. R. A.

Calculation of the kinetics of hydrolysis of polysaccharides. Mathematical expressions and results. G. BLOMQVIST (Sitzungsber. Heidelberg. Akad. Wiss., Math.-nat. Kl., 1936, No. 7, 11 pp.; Chem. Zentr., 1937, i, 2178).—Published formulæ are summarised, and further expressions are deduced. A. J. E. W.

Reduction of carbon dioxide by graphite and coke. M. A. MAYERS (J. Amer. Chem. Soc., 1939, 61, 2053—2058).—The rates of reaction (k) of CO_2 with natural (I) and artificial (II) graphite and with various high-temp. cokes (III) have been measured. (II) and (III) behave as porous substances the internal surfaces of which contribute to k. The heats of activation are: with (I) ~44, (II) ~52 kg.-cal. The results which give k per unit vol. of (I), (II), or (III) are liable to errors of ~20%. W. R. A.

Velocity of dissolution of comminuted substances. XI. Velocity of dissolution of alabaster in water. W. JACEK (Rocz. Chem., 1939, 19, 463—470).—The velocity of dissolution of

alabaster in H_2O at 12·5—24° has been determined. The temp. coeff. is 1·36. R. T.

Rate of dissolution of calciferous inorganic and organic substances in an aqueous medium. H. KLÄHN (Zentr. Min., 1936, A, 328—348, 369—384; Chem. Zentr., 1937, i, 2343).—The rate of dissolution of powdered $Ca(OH)_2$ in H_2O in equilibrium with atm. CO_2 is studied; linear relations exist between the time of dissolution or the amount of H_2O and the wt. of dissolved solid. The wt. dissolved in a given vol. of H_2O is independent of the wt. of $Ca(OH)_2$ present after 1 hr., but increases with this wt. after 3 days. With compact calciferous substances the rate is $\propto$ surface area. A. J. E. W.

Oxidation of zinc sulphide and transference of zinc into aqueous or alkali solution at air pressure. V. G. TRONEV and S. M. BONDIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 541—543).—The rate of dissolution of ZnS in H_2O and 4N-NaOH, but not in 0·1N-H_2SO_4, was increased in air at pressures $\Rightarrow$85 atm. In H_2O the rate of dissolution increased with temp. from 25° to 200°. L. J. J.

Oxidation of cupric sulphide and transference of copper into aqueous solution at air pressure. O. E. ŽVJAGINTZEV and V. G. TRONEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 537—540).—The rate of dissolution of CuS in H_2O in contact with air has been studied at pressures $\Rightarrow$100 atm. and temp. $\Rightarrow$250°. $CuSO_4,2Cu(OH)_2$ is formed in the course of the reaction as an additional solid phase. The rate is $\propto$ the partial pressure of O_2, and at 100 atm. is a max. at ~200°. L. J. J.

Passivity of iron. I. Kinetics of dissolution of iron in nitric acid. M. S. GOLOMBIK, M. M. LEVINA, and N. N. PETIN (J. Phys. Chem. Russ., 1939, 13, 425—435).—In HNO_3 of concn. c = 3—7N., Fe dissolves readily at 20°, the reaction being formally unimol. The rate, v, is increased by stirring and the temp. coeff. is 1·3, indicating that the rate-determining process is diffusion. If $c = 8$—12N. the reaction is pulsating, and with increasing c the period of induction, period of pulsation, and time between successive pulsations fall, although the no. of pulsations is const. When $c = 13$—15·7N. passivation is complete. In the active region v runs approx. parallel to the sp. conductivity of the solution, both being a max. at 6·8N., suggesting that v is determined by the $H^{·}$ ion activity. Assuming that an intermediate product in dissolution is $Fe(NO)(NO_3)_2$ (cf. A., 1937, I, 250), the pulsations may be due to temporary exhaustion of the HNO_3 at the metal surface. In addition, the HNO_3 presumably forms a protective coating on the surface of the Fe, so that the periodicity of reaction represents competition between H and O for the Fe surface. R. C.

Sensitised explosions. IV. Carbon monoxide–oxygen reaction catalysed by nitrogen peroxide. E. J. BUCKLER and R. G. W. NORRISH (Proc. Roy. Soc., 1939, A, 172, 1—28; cf. A., 1938, I, 626).—NO_2 does not sensitise the ignition of pure dry CO and O_2, but in presence of NO_2 and H_2 explosion occurs 300° below the temp. required to ignite the pure gases. The variation of induction period with [H_2] has been studied and leads to the view that explosion is due to a chain-branching mechanism. The ignition of $CO-O_2-NO_2$ mixtures containing H_2O vapour was also investigated. G. D. P.

Kinetics of the thermal decomposition of the methylamines. II. M. W. TRAVERS and J. A. HAWKES (J.C.S., 1939, 1360—1364; cf. A., 1939, I, 326).—Low concns. of NO cause a greater relative inhibition of the formation of H_2 than of CH_4 in the thermal decomp. of NMe_3 but higher [NO] causes considerable decrease in the CH_4 formation. This is attributed to the reversibility of the reaction between the free radicals and NO, i.e., of the inhibition process. With $NHMe_2$ little inhibition of either H_2 or CH_4 formation occurs until ~1·2% of NO is added. This may be due to formation of an additive compound which changes irreversibly into decomp. products with removal of NO. The decreases in yields of CH_4 and H_2 proceed in a parallel manner, suggesting that they are produced by processes initiated by the same free radical or that the effect of the NO is the same in each case. With NH_2Me increasing amounts of NO decrease the amount of H_2 formed until it equals the amount of CH_4 formed, but have no effect on the latter. It is inferred that there are two reactions, one, probably $NH_2Me \rightarrow HCN + 2H_2$, resulting in formation of H_2 and suppressed completely by NO, the other resulting in the formation of equal vols. of CH_4 and H_2 and unaffected by NO. NO simply dissolves in NH_2Me but appears to form loose compounds with $NHMe_2$ and NMe_3. NO reacts with $NHMe_2$ and NMe_3 at 420°, with formation of N_2 and N_2O, respectively, H_2O and condensation products being also formed in each case. Only traces of N_2 and CH_4 are produced. J. W. S.

Inhibition phenomena in the catalysed oxidation of iodide ion by chlorate. II. Ruthenium chloride as catalyst. K. WEBER and R. VALIČ (Ber., 1939, 72, [B], 1488—1495; cf. A., 1938, I, 404).—Although with $VOSO_4$ as catalyst, or in the absence of a catalyst, the reaction velocity increases with increasing [$H^{·}$], with $RuCl_3$ as catalyst the reverse is true. The results accord with the view that the true catalyst is the ion $[Ru(OH)]^{··}$, resulting from hydrolysis which is repressed by acid, and that the rate $\propto$ $[Ru(OH)^{··}][HCl]^{\frac{1}{2}}$. SO_4'' ions also retard the reaction, probably owing to the formation of slightly-dissociated basic Ru sulphates and consequent removal of the catalyst ion. The temp. coeff. is 1·9 for 10°. F. J. G.

Reactions in concentrated sulphuric acid. XVI. Selenium and tellurium as catalysts. J. MILBAUER (Chem. Obzor, 1939, 14, 105—111).—The behaviour of equiv. amounts of Se, SeO_2, and mixtures of the two on the reaction between C_2H_2 and conc. H_2SO_4 is traced. The oxide is in excess at the equilibrium point owing to the more rapid oxidation of Se by H_2SO_4 than reduction of SeO_2 by C_2H_2. This is especially evident at 100°. Te is oxidised much more slowly than Se at lower temp. but both are very rapidly oxidised at 200° in a stream of N_2. That an equilibrium is attained between the Se and the SeO_2 was proved by a colorimetric study of the

action at 228° showing the presence of 1·5% Se at equilibrium with H_2 gas and 7·4% Se with CO_2. When using Se or SeO_2 alone as catalyst the reaction velocity increases to a max. corresponding with the equilibrium $xSe + ySeO_2$, when the results remain const. It is necessary to pass a mixture even of H_2 and air through the acid for a long time to obtain const. and max. results, but with CO_2 and air const. results are obtained immediately the temp. is const. The phenomenon is not caused by traces of H_2O or SO_2 formed in reaction or by the effect of light. F. R.

Effect of acetone on optical rotation of tartaric acid and on the rate of its reaction with ethyl alcohol. A. P. TROFIMENKO and S. F. BABAK (J. Phys. Chem. Russ., 1939, **13**, 417—420).—The sp. rotation is reduced and the reaction retarded.

R. C.

Homogeneous catalytic hydrogenation. M. CALVIN (J. Amer. Chem. Soc., 1939, **61**, 2230—2234). —From an investigation of the kinetics of the hydrogenation of benzoquinone in quinoline solution using dissolved $Cu_2(OAc)_2$ as homogeneous catalyst (A., 1938, I, 628) it is concluded that a dimeride of the $Cu_2(OAc)_2$–quinoline complex is probably responsible for the activation of the mol. H_2. The previously proposed mechanism of the hydrogenation is confirmed. W. R. A.

Effect of polar groups on esterification velocities of substituted benzoic acids with *cyclo*hexanol. R. J. HARTMAN, L. B. STORMS, and A. G. GASSMANN (J. Amer. Chem. Soc., 1939, **61**, 2167—2169; cf. A., 1938, I, 36).—The effect of polar substituents (Me, NO_2, Br, Cl) on the reaction velocity of $H^{\cdot}$ ion-catalysed esterification of BzOH with *cyclo*hexanol has been investigated at 55°, 60°, 70°, and 75°. The velocity coeff. decreases in the order $m\text{-}NO_2 > m\text{-}Cl > m\text{-}Br > p\text{-}Cl > m\text{-}Me > p\text{-}Me$. Experimental vals. for log k for the esterification reactions agree with those calc. on the basis of Hammett's equations. The significance of the energy of activation in determining the velocity of esterification is discussed. W. R. A.

Energy of activation of hydrolysis of sodium β-glycerophosphate by bone-phosphatase at optimal p_H.—See A., 1939, III, 872.

Activation of hydrogen in catalytic reactions of hydrocarbons. A. FARKAS (Trans. Faraday Soc., 1939, **35**, 906—917).—A review of the reactions of hydrocarbons catalysed by metals which do not involve breakage of C–H bonds. It is concluded that catalytic hydrogenation consists in the simultaneous addition of the atoms of a H_2 mol. to a single or double bond and necessarily in the *cis* position. In hydrogenation by nascent H and at high temp. the thermodynamically stable isomerides (usually *trans* or *meso*) are formed by addition of independent H atoms, which is in agreement with known data. The catalytic exchange reaction between H_2 and hydrocarbons is considered to proceed by a dissociative mechanism according to which the hydrocarbons are partly split into H atoms and hydrocarbon radicals on the surface of the catalyst, affording an explanation for the kinetics of the exchange reaction of various saturated

and unsaturated hydrocarbons, catalytic *cis–trans* conversion, racemisation, migration of double bonds, disproportionation of *cyclo*hexanes and related compounds, and for some polymerisation reactions.

F. R. G.

Catalytic exchange of hydrogen atoms between molecular deuterium and *n*-hexane and *cyclo*hexane. A. FARKAS and L. FARKAS (Trans. Faraday Soc., 1939, **35**, 917—920).—$n\text{-}C_6H_{14}$ was equilibrated at 75° with 98% D_2 giving a distribution ratio of $(H/D)_{hydrogen} \cdot (D/H)_{hexane} = 1\cdot94$. The half-period of the exchange is recorded over the range 31—124°. For the exchange between *cyclo*hexane and D_2 the results between 15° and 98° are similar. The rate of dehydrogenation of *cyclo*hexane to C_6H_6 (cf. Schultze, B., 1936, 535) is too slow to account for the rate of the exchange. It is suggested that the exchange of both hydrocarbons involves the dissociation of the hydrocarbons into H atoms and radicals on the surface of the catalyst. F. R. G.

Mechanism of catalytic exchange reactions between deuterium and olefines.—See A., 1939, II, 465.

Hydrogenation of nickel carbonyl. (A) M. K. CHAKRAVARTY. (B) E. E. LITKENHOUS (Ind. Eng. Chem., 1939, **31**, 1059—1060, 1060).—(A) Results of Litkenhous and Mann (A., 1937, I, 521) obtained during the hydrogenation of CO in presence of Ni, using $Ni(CO)_4$ and H_2 as reactants, lead to the conclusion that the main reactions occurring after complete decomp. of $Ni(CO)_4$ are : $CO + H_2 \rightleftharpoons C + H_2O$ and $2CO + 2H_2 \rightleftharpoons CO_2 + CH_4$ and not $2C + 2H_2O \rightleftharpoons CH_4 + CO_2$ as suggested by the authors.

(B) A reply to the above. F. H.

Determination of activity of nickel catalysts. A. ZINOVIEV (Maslob. Shir. Delo, 1939, No. 3, 10—13). —The velocity coeff. k of the reaction of hydrogenation of unsaturated acids is calc. from the formula $k = [2\cdot303/(t_2 - t_1)] \log I_{t_1}/I_{t_2}$, where $t_2 - t_1$ is a time interval ($t_1 \ll 1$ hr., t_2 2—2·5 hr.), and I_{t_1} and I_{t_2} are the I vals. at the beginning and end of this interval. The activity of Ni catalysts is expressed as k_2/k_1, where k_1 and k_2 are the vals. found for a reference catalyst and for the catalyst under examination, respectively. R. T.

Active iron and copper compounds as inorganic catalysts in reactions of peroxidative oxidation, in the light of the theories of oxygen and hydrogen activation. A. KRAUSE (Rocz. Chem., 1939, **19**, 481—486).—Activation of ortho-ferric oxide by CuO in the reaction of oxidation of HCO_2H by H_2O_2 is represented by the reactions : $Cu(OH)_2 + H_2O_2 \rightarrow CuO_2 + 2H_2O$; $\cdot Fe(OH)\cdot O\cdot Fe(OH)\cdot$ (I) $+ CuO_2 \rightarrow O{<}^{Fe\cdot O}_{Fe\cdot O}$ (II) $+ Cu(OH)_2$; (II) $+ HCO_2H \rightarrow$ (I) $+ CO_2$. The process is thus one of activation of oxygen. R. T.

Dispersion of platinum catalysts. A. M. RUBINSTEIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 57—60).—The structure of three preps. of Pt on activated C and one of Pt on Al_2O_3 has been studied by X-ray methods. The X-ray diagram of Pt–Al_2O_3 shows lines due to both components, but that of Pt–C

shows lines due to Pt only. The greater activity in dehydrogenation and dehydration reactions of preps. obtained by thermal decomp. of H_2PtCl_6 on C seems to depend on the slightly deformed unit cell of Pt in these catalysts, as the dispersion of all the preps. was the same. Work on the effect of the degree of dispersion on the activity of Pt catalysts is summarised, and confirms the existence of an optimum degree of dispersion for mixed catalysts. A. J. M.

Fundamentals in the catalytic ring closure of open-chain hydrocarbons. H. S. TAYLOR and J. TURKEVITCH (Trans. Faraday Soc., 1939, **35**, 921—934).—n-C_7H_{16} with Cr_2O_3 gel at 468° yields a liquid product containing 100% of aromatics which is essentially PhMe. The catalyst is poisoned by H_2O and C_2H_4 and regenerated by O_2. Olefines with Cr_2O_3 gel show initially a higher rate of conversion into aromatics but there is more rapid deterioration of the catalyst owing to side reactions. The ring closure of hydrocarbons is discussed from the thermodynamic point of view and it is concluded that oxides are the most suitable catalysts as they activate the C–H bond, and that temp. should be $>300°$. F. R. G.

Heavy metal sulphides as catalysts for polymerisation of olefine hydrocarbons. E. H. INGOLD and A. WASSERMANN (Trans. Faraday Soc., 1939, **35**, 1022—1024; cf. A., 1938, I, 145; 1939, I, 269).—The dimerisation of *cyclo*pentadiene becomes heterogeneous in presence of heavy metal sulphides. Only black sulphides are effective. Results of experiments with 17 olefines are tabulated. The efficiency of the catalyst (CuS) depends markedly on its mode of prep. and on admixtures. A mechanism is suggested. F. L. U.

Activation process and nature of active centres in catalysed electrolytic hydrogenation. V. V. MONBLANOVA, N. I. KOBOZEV, and P. S. FILIPPOVITSCH (J. Phys. Chem. Russ., 1939, **13**, 326—340).—The effect of catalyst poisons present in the solution and on the electrode on the cathodic reduction of dissolved $CHPh:CH \cdot CO_2H$ at 20° has been studied. Hg and As retard hydrogenation on electrodes with a high H overvoltage (Sn, Pb, and Hg), but they activate electrodes with a low overvoltage (Pt and Fe) by an amount which passes through a max. with increasing concn. of poison. These results accord with the theory that H overvoltage rises as the energy of linking of H atoms to the electrode falls, and that the activating action of poisons is due to depression of the activation barrier. Temp. coeff. measurements show that the more the cathode surface is poisoned, the lower is the energy of activation of the reaction. The active centres seem to be points of depressed adsorption potential for H and contain, in Pt and Fe, on the average, 2 atoms. Both bright and platinised Pt after being covered with the same electro-deposited film of Hg are equally active, showing that despite the large difference between the surface areas there is no difference in " polarisation " surface. This observation throws doubt on the experimental basis of the electrostatic theory of overvoltage. R. C.

Catalytic hydrogenation of phenolic oil in low-temperature tar.—See B., 1939, 903.

Production of ethane, quinhydrone, and potassium cupric cyanide by a.c. electrolysis. J. W. SHIPLEY and M. T. ROGERS (Canad. J. Res., 1939, B, **17**, 167—177).—The electrolytic production of C_2H_6 from KOAc, of benzoquinone (I) from quinol, and of $K_3Cu(CN)_4$ from Cu electrodes in KCN, by means of a.c., and the dependence of the yield on the conditions, have been studied. A good yield of (I) is obtained at moderately high c.d. F. J. G.

Electrolysis of sodium sulphate solution.—See B., 1939, 957.

Anodic oxidation of aluminium.—See B., 1939, 949.

Mechanism of photochemical production of hydrogen peroxide. K. YAMAFUGI, N. NISHIOEDA, and H. IMAGAWA (Biochem. Z., 1939, **301**, 404—417; cf. A., 1939, III, 622; Baur and Neuweiler, A., 1928, 30).—Evidence is adduced to support the view that the mechanism is expressed by the equations: $2H_2O \rightarrow H_2O_2 + 2H$, $2H + O_2 = H_2O_2$, and $AH_2 + O_2 \rightarrow H_2O_2 + A$ (A = an oxidisable substance) and experiments in which ZnO, eosin, glucose, hæmatoporphyrin, chlorophyll, and other substances are used as sensitisers are described. W. McC.

Colour change in barytes under the action of X-rays. M. KOŁACZKOWSKA (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 181—186; Chem. Zentr., 1937, i, 1376).—Colourless Příbrám barytes becomes blue on exposure to X-rays, and emits secondary radiation. Sunlight destroys the colour in 15—20 min. The coloration is due to intra-at. processes. A. J. E. W.

Electrolytic development of the latent image. R. S. MORSE (J. Franklin Inst., 1939, **228**, 169—175). —If photographic material of the Ag halide type is exposed and bathed in aq. NH_3 or in aq. NH_3 containing a trace of a suitable metallic salt and then placed in intimate contact with a clean Cu plate a visible image is produced. Addition of the salt to the aq. NH_3 diminishes fogging. The images produced are similar to those produced by chemical development and are obtained by pre- and post-fixation treatment. The grain structure has been examined at various depths throughout the emulsion and the reaction is not of the surface type. The image is essentially Ag. A theoretical explanation is advanced. W. R. A.

Action of ultra-violet rays on glyceryl nitrate. T. URBANSKI, W. MALENDOWICZ, and K. DYBOWICZ (Compt. rend., 1939, **209**, 103—105; cf. B., 1939, 782).—p_H measurements show that glyceryl nitrate (I) undergoes slow spontaneous decomp. for some hr. after exposure to ultra-violet light, the ultimate degree of decomp. increasing with the light intensity. The irradiated (I) explodes after a shorter period on heating, and gives a shorter Taliani–Goujon test than ordinary (I). Similar effects are observed with erythritol and mannitol nitrates. A. J. E. W.

Anaërobic photochemical reduction of redox dyes by pyruvic acid, lactoflavin, and quinine. W. SEITZ (Z. Vitaminforsch., 1939, **9**, 32—38).— Photochemical degradation of $AcCO_2H$ (I) occurs in presence or absence of O_2. (I) and, to a $>$ stoicheiometric extent, lactoflavin (II) photochemically reduce

Capri-blue. Reduction of the dye by (I) is accelerated catalytically by (II) (*e.g.*, 30-fold by 0·5 µg.). Quinine sensitises only (II)–acceptor systems. All the above reactions are inhibited by pyramidone.   F. O. H.

Influence of irradiation with radon on different types of glass. J. WIESTHAL (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, **145**, 239—260; Chem. Zentr., 1937, i, 1369).—The solubility of seven glasses in H_2O at 90° is increased by irradiation with α- and γ-rays from Rn, although the effect is not $\propto$ the quantity of Rn; the solutions contain Si, B, Al, Na, Ca, Ba, Mg, and K. Various related effects are detailed. Irradiation causes attack of the glass structure, which is particularly marked with glasses containing Al_2O_3. The solubility of unirradiated glasses increases with the alkali content, although SiO_2, Al_2O_3, and B_2O_3 are dissolved at the beginning of the H_2O treatment.   A. J. E. W.

Mechanism of Wagner–Meerwein rearrangement. Exchange of deuterium between camphene hydrochloride and hydrogen chloride.—See A., 1939, II, 434.

Crystallisation of vitreous sodium and calcium metaphosphates. R. PÂRIS and A. BOULLÉ (Compt. rend., 1939, **209**, 223—225).—The transformation points of $NaPO_3$ and $Ca(PO_3)_2$ are shown by thermal analysis to be 280° and 520°, respectively, coinciding closely with the softening temp. (295°, 530°). Crystallisation (which is accompanied by marked heat absorption) commences at approx. the same temp. (315°, 560°), at which it is very slow; the max. rate is reached at 440° or 760°. $Ca(PO_3)_2$ can be heated rapidly to ∼580° without crystallisation, and shows the reversibility of the thermal anomaly at the transformation temp.   A. J. E. W.

Exchange of sodium and calcium ions on glauconite. P. M. TSCHULKOV (J. Gen. Chem. Russ., 1939, **9**, 571—574).—The expression $Y_{Na}/Y_{Ca}^{\frac{1}{2}} = 0·273 C_{Na}/C_{Ca}^{\frac{1}{2}}$ (Y and C are g.-mol. of Na or Ca per kg. of glauconite or H_2O, respectively) is derived and verified.   R. T.

Reactions of olefines with solid cuprous halides. E. R. GILLILAND, J. E. SEEBOLD, J. R. FITZHUGH, and P. S. MORGAN (J. Amer. Chem. Soc., 1939, **61**, 1960—1962).—At low temp. C_2H_4, C_3H_6, and *iso*-C_4H_8 react with Cu_2Cl_2 and give practically identical equilibrium pressure curves. C_2H_4 reacts with Cu_2Br_2. The compounds formed are Cu_2X_2,C_nH_{2n}. Dissociation pressure curves have been obtained. No reaction takes place at temp. > those corresponding with the intersection of the dissociation curve and the v.p. curve of the olefine. Heats of reaction varied from 11,000 g.-cal. per mol. at low temp. to 7000 at high temp. Olefines may be recovered from liquid or gaseous mixtures by Cu^I halides and a method of calculating the theoretical max. recovery is outlined.   W. R. A.

Basic phosphates of beryllium and zinc. A. A. SANFOURCHE (Compt. rend., 1939, **209**, 107—109).—No Be or Zn hydroxyapatites are obtainable by the methods applied with Mg salts (A., 1939, I, 210). The action of Na_3PO_4 on aq. $Be(NO_3)_2$ containing dissolved $Be(OH)_2$ yields mixtures of hydrated $Be(OH)_2$ and $Be_3(PO_4)_2$. Treatment of $Be_3(PO_4)_2,5·75H_2O$ with

successive quantities of boiling 0·1N-NaOH until alkaline (phenolphthalein) (cf. Klement, A., 1938, I, 320) gives a double *salt*, $Be_3(PO_4)_2,2NaOH,2·5H_2O$, which loses all its H_2O at <500°. The corresponding reactions with Zn salts yield mixtures, the product from $Zn_3(PO_4)_2$ and NaOH containing a tetrabasic Zn Na orthophosphate.   A. J. E. W.

Perchlorates. V. Ammoniates of alkaline-earth perchlorates. C. SMEETS (Natuurwetensch. Tijds., 1939, **21**, 149—158).—Alkaline-earth perchlorates react with gaseous NH_3 to form the following ammines (heats of formation, where determined, are given in parentheses) : $Mg(ClO_4)_2,2NH_3$; $Mg(ClO_4)_2,6NH_3$ (99,100); $Ca(ClO_4)_2,2NH_3$; $Ca(ClO_4)_2,3NH_3$; $Ca(ClO_4)_2,6NH_3$ (72,600); $Sr(ClO_4)_2,2NH_3$; $Sr(ClO_4)_2,6NH_3$ (64,900); $Sr(ClO_4)_2,7NH_3$ (74,200); $Sr(ClO_4)_2,10NH_3$; $Sr(ClO_4)_2,12NH_3$; $Ba(ClO_4)_2,2NH_3$; $Ba(ClO_4)_2,5NH_3$; $Ba(ClO_4)_2,6NH_3$ (54,300 cal.); $Ba(ClO_4)_2,9NH_3$. The heat of formation of these complex amines is the smaller the greater is the size of the cation.   S. C.

Reactions [taking place] on carbon. V. SHIVONEN (Suomen Kem., 1939, **12**, **B**, 15).—The primary reaction in the oxidation of graphite by N_2O is : $C_{n+1} + N_2O \rightarrow C_{n+1}O + N_2$, followed by : $C_{n+1}O \rightarrow C_n + CO$. CO is preferentially adsorbed and inhibits further reaction at low temp., but at high temp. N_2O reacts with the absorbed CO : $C_n . CO + N_2O \rightarrow C_n + CO_2 + N_2$, followed by the primary reaction again. Between 770° and 1120°, at pressures <50 mm. Hg, HCO_2H decomposes bimolecularly on both Pt and graphite : $2HCO_2H \rightarrow H_2 + CO + CO_2 + H_2O$. There was no reaction between graphite and H_2.   M. H. M. A.

Coloured Tl^{III} oxides. S. KRZYŻAŃSKI (Rocz. Chem., 1939, **19**, 419—425).—Grey, yellow, red, purple, violet, blue, and green ppts. of Tl_2O_2 are obtained by adding LiOH and H_2O_2 to aq. $TlNO_3$, at room temp.; the colour of the ppts. changes with time in a definite sequence. The colours are due to interference effects given by the laminar micro-crystals of Tl_2O_3.   R. T.

Crystalline lead orthophosphate. E. J. ROEHL (J. Amer. Chem. Soc., 1939, **61**, 2249).—When a 1% solution of Na_2HPO_4 is separated by a Cellophane membrane from a slightly acidified 0·2% solution of $Pb(OAc)_2,3H_2O$ amorphous $Pb_3(PO_4)_2$ forms immediately, and after about 1 min. tiny white crystals separate. These crystals are uniaxial hexagonal prisms exhibiting strong birefringence and an optically negative character.   W. R. A.

Oxidation of phosphorus at solid surfaces. T. A. KRIUKOVA (J. Gen. Chem. Russ., 1939, **9**, 577—586).—The process of oxidation by atm. O_2 or ozonised air of yellow P finely distributed on SiO_2 powder at 20° involves the stages $P \rightarrow P_4O \rightarrow P_4O_2 \rightarrow P_4O_6 \rightarrow P_4O_{10}$. The ratio of P_4O to P_4O_{10} in the final reaction product is 2 : 3. The mechanism of the reaction is discussed.   R. T.

Complex compounds $P(OH)_4ClO_4$ and $Se(OH)_3ClO_4$. E. J. ARLMAN (Rec. trav. chim., 1939, **58**, 871—874).—The *compound* $H_2SeO_3,HClO_4$, or $[Se(OH)_3]ClO_4$, is described. On electrolysis of its

solution in $MeNO_2$, Se migrates to the cathode. Vals. of Λ for this solution, and for that of $[P(OH)_4]ClO_4$ (A., 1937, I, 628), resemble vals. for other perchlorates, confirming the view that dissociation to $[P(OH)_4]^+$ or $[Se(OH)_3]^+$ and ClO_4^- occurs. F. J. G.

Salts derived from triphosphoric acid. P. BONNEMAN (Compt. rend., 1939, **209**, 214—216).— The following sparingly sol. salts have been prepared by mixing dil. solutions of $Na_5P_3O_{10},6H_2O$ (A., 1937, I, 195) and a salt of the metal, in the proportions shown by conductometric titration to yield definite compounds : $Zn_2NaP_3O_{10},9\cdot5H_2O$; $ZnNa_3P_3O_{10},11\cdot5H_2O$ (H_2O readily lost at 80°) ; $5CaO,3P_2O_5$; $Ca_2NaP_3O_{10},4H_2O$; $5SrO,3P_2O_5$; $Sr_2NaP_3O_{10},7H_2O$; $5BeO,3P_2O_5$; $Be_2NaP_3O_{10},5H_2O$; $5PbO,3P_2O_5$; $PbNa_8(P_3O_{10})_2,14H_2O$; $CdNa_3P_3O_{10},12H_2O$; $Cd_2NaP_3O_{10},7H_2O$; $MnNa_3P_3O_{10},12H_2O$; $5MnO,3P_2O_5$; and $CoNa_3P_3O_{10},12H_2O$. The existence of $CaNa_3P_3O_{10}$ and $SrNa_3P_3O_{10}$ is indicated by the titration curves, but these salts were not isolated. A. J. E. W.

Mechanism of the genesis of polymorphous forms. M. C. BLOOM (Amer. Min., 1939, **24**, 283—292).—Solubility measurements show that valentinite (I), the high-temp. form of Sb_2O_3, is not a thermodynamically stable phase, except in the sense that it is apparently in equilibrium with the solution from which it is grown. Passive resistance to reorganisation of the structure allows equilibrium to exist at a higher free energy than the min. for the system. Sb_2O_3 prepared by atm. oxidation of Sb under H_2O is in the form of senarmontite (II), but pptn. from $0\cdot01N$-HCl, $0\cdot01N$-H_2SO_4, or $0\cdot06N$-$HClO_4$ yields (I) ; from $0\cdot01N$-$HClO_4$ a mixture of (I) and predominating (II) is formed. These results are explained in terms of interstitial accommodation of the foreign anion in the Sb_2O_3 structure. Anomalies connected with the genesis of unstable polymorphous forms are discussed. L. S. T.

Salts of thiolbenziminazole. M. KURAŠ (Chem. Obzor, 1939, **14**, 49—51).—Thiolbenziminazole (I) forms with cations of the H_2S group insol. compounds suitable for quant. analysis. From the corresponding mineral acid solution $M_3Bi,3H_2SO_4$ (orange-yellow), $M_3Bi,3HNO_3$ (cinnabar-red), and $M_3Bi,3HCl$ (chrome-yellow) are pptd. (M = $C_7H_5N_2S$). From ammoniacal solution, Pb^I salts give quantitatively a white basic ppt., MPbOH ; Cd^I salts a white microcryst. ppt. of $MCd(OH),NH_3$, and Cu^I salts a dark grey-blue ppt. of basic salt MCu(OH). Cu^I salts in EtOH solution give a yellow-ochre Cu^I salt whilst an excess of (I) gives complex violet salts sol. in EtOH as a red solution. F. R.

Synthesis and analysis of vanadium sulphides. J. I. GERASIMOV and I. K. TSCHUNICHINA (J. Gen. Chem. Russ., 1939, **9**, 481—483).—V_2S_2 is obtained from V_2O_5 and S at 400° in a CO_2 atm., or by passing H_2S over V_2O_5 at 400—550° ; V_2S_3 by passing CS_2 vapour over V_2O_5 at 700°, and V_2S_5 from V_2S_3 and S at 400°. The sulphides are analysed by Lunge's method. R. T.

Radioactive sulphur for biochemical experiments. J. L. TUCK (J.C.S., 1939, 1292—1294).— Radioactive ^{35}S in the form of aq. H_2S shows no

exchange reaction with cysteine hydrochloride, $SH\cdot CH_2\cdot CO_2H$, allylthiocarbamide, or $CS(NH_2)_2$. $CS(NH_2)_2$ also shows no exchange with radioactive S in aq. NaSH alone or in presence of $Cu^{\cdot\cdot}$, $Fe^{\cdot\cdot}$, and $Mn^{\cdot\cdot}$ which often catalyse reactions of org. thiocompounds. It is concluded that the thiol group in cysteine and allied compounds is firmly bound and that radioactive S can be used as indicator in such compounds. It is also inferred that the nitroprusside reaction with $\cdot SH$ is non-ionic. J. W. S.

New class of ammines. Complex thiomolybdates and thiotungstates. G. SPACU and A. POP (Bull. Acad. Sci. Roumaine, 1939, **21**, 188—198).— The following complex *salts* have been obtained by double decomp. : $[MoS_4][Ni\ en_3]$; $[MoS_4][Zn\ en_3]$; $[MoS_4]_3[Cr\ en_3]_2$; $[MoS_4]_3[Co\ en_3]_2$; $[MoS_4]_3[Cr(urea)_6]_2,4H_2O$; $[MoS_4]_3[Cr(antipyrine)_6]_2$; $[WS_4][Ni\ en_3]$; $[WS_4][Zn\ en_3]$; $[WS_4]_3[Cr\ en_3]_2$; $[WS_4]_3[Co\ en_3]_2$; $[WS_4]_3[Cr(urea)_6]_2,4H_2O$; $[WS_4]_3[Cr(antipyrine)_6]_2$. F. J. G.

Sulpho-ceruleomolybdic acid and its salts. V. AUGER and (MLLE.) N. IVANOFF (Compt. rend., 1939, **209**, 216—218).—Solutions containing sulpho-ceruleomolybdic acid, $H_5(MoO,Mo_2O_8)SO_4,nH_2O$ (I), are obtained by hydrolysis of the blue-violet H_2SO_4 solution containing the calc. proportions of MoO_3 and Mo^V (details given), by reduction of a H_2SO_4 solution of MoO_3 with SO_2, or more conveniently by hydrolysis of the tetra-acetate (A., 1936, 691) with boiling H_2O. Impure cryst. (I) ($n \sim 12$) is obtained by evaporation of the BuOH extract of the acid aq. solution. (I) is very sol. in H_2O, and is rapidly oxidised in air. Aq. alkalis (or NaOAc etc.) remove all the (I) from its BuOH solutions, but none is extracted by aq. acids. Addition of NH_4Cl to aq. (I) affords a bluish-black $(NH_4)_3H_2$ salt ; excess of aq. NH_3 in presence of NH_4Cl ppts. a bright blue-green $(NH_4)_5$ salt. Similar K salts exist, but have not been isolated. A. J. E. W.

Chemical methods of concentrating radioactive halogens. C. S. LU and S. SUGDEN (J.C.S., 1939, 1273—1279).—After $C_2H_4Br_2$, PhCl, PhBr, PhI, Bu^aBr, Bu^aI, or CCl_4 has been irradiated with neutrons from $RaSO_4$ and Be a large proportion of the radioactive halogen formed can be extracted with H_2O, aq. solutions, or finely divided metals. The fraction of the activity extracted by aq. solutions is increased by the addition of NH_2Ph (4%) or other org. base before irradiation. Radioactive I is separated mainly as the element, but Cl and Br are extracted principally as ions. The presence of free halogen increases the amount of radioactive isotope obtained from aliphatic halides, but not that from aromatic halides. A method permitting extraction of radioactive Br from $C_2H_4Br_2$ with a concn. factor of 31,000 is described. J. W. S.

Chemistry of manganese salt melts. I. Reaction of manganese chloride with chlorides of univalent metals. E. R. NATZVLISCHVILI and A. G. BERGMAN (J. Gen. Chem. Russ., 1939, **9**, 642—646).— A 1 : 1 *compound*, m.p. 497°, is formed in the system $MnCl_2$–TlCl, and 1 : 1 and 1 : 2 *compounds*, m.p. 552° and 466°, respectively, in the system $MnCl_2$–RbCl. R. T.

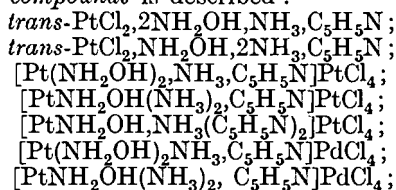**Hydrates of manganous sulphate.** J. PERREU (Compt. rend., 1939, **209**, 167—169).—$MnSO_4,4H_2O$ gives the anhyd. salt on heating to const. wt. at 280°; the monohydrate is obtained at 110°, or at room temp. over H_2SO_4 in a vac. Tensimetric measurements during isothermal dehydration (22°; P_2O_5, in vac.) confirm the existence of the monohydrate, but there is no evidence of definite hydrates with 2 or $3H_2O$ (cf. de Forcrand, A., 1914, ii, 658, 659). Products of this composition prepared by controlled dehydration are shown by X-ray analysis to be mixtures.   A. J. E. W.

Relative dissymmetric synthesis and rotation dispersion in cobaltic complexes of the α-amino-acids. I. LIFSCHITZ (Rec. trav. chim., 1939, **58**, 785—799; cf. A., 1939, I, 212).—The prep. of the following *compounds* is described ($A = d$-alanine, $B = l$-leucine): [Co en$_2A$]$(NO_3)_2$,1·5 and 3 H_2O; d- and l-[Co en$_2A$](d-$C_{10}H_{15}O_4BrS)_2,H_2O$; [Co en$_2B$]Cl$_2$; [Co en$_2B$]I$_2,H_2O$; d- and l-[Co en$_2B$](d-$C_4H_4O_6),3H_2O$.   F. J. G.

Cobaltammine salts of 12-molybdophosphoric acid. H. A. HORAN (J. Amer. Chem. Soc., 1939, **61**, 2022—2025).—The compositions of the pentammino- and hexammino-cobaltic salts of 12-molybdophosphoric acid are $[Co(NH_3)_5H_2O]PMo_{12}O_{40},4H_2O$ and $[Co(NH_3)_6]PMo_{12}O_{40},3H_2O$ (I). In both types the H_2O of crystallisation is principally lattice H_2O. Owing to the intermediate reaction $[Co(NH_3)_5X]^{\cdots} + H_2O \rightarrow [Co(NH_3)_5(H_2O)]^{\cdots} + X$ (X = Cl, NO) the same pentammine product is always obtained. The use of (I) as a reagent for the determination of PO_4''' is recommended.   W. R. A.

Complex compounds of platinum and buta-diene (divinyl). A. GELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 532—536).—The prep. and properties of the following *butadienoplatinous compounds* are described: $(NH_4)_2[C_4H_6(PtCl_3)_2]$; $[Pt(NH_3)_4][C_4H_6(PtCl_3)_2]$; $C_4H_6(PtCl_2,NH_3)_2$: *trans-trans-*, n 1·77—1·78, decomp. 185—188°; *cis-cis-*, decomp. 202—204°; $C_4H_6(PtCl_2,C_5H_5N)_2$: *trans-trans-*, m.p. 138—140°; $PtCl_2,C_4H_6,C_5H_5N$: *cis-*, m.p. 155—158° (decomp.); *trans-*, m.p. 125—130°; $PtCl_2,C_4H_6,NH_3$: *trans-*, m.p. 172—174° (decomp.). Each double bond of the butadiene mol. has a high *trans*-activity; either one or both may form co-ordinate links.   L. J. J.

Mixed platinum hydroxylamine tetrammines. V. I. GOREMIKIN and K. A. GLADISHEVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 544—547).—The prep. of the following *hydroxylamino-ammino-platinous compounds* is described :

trans-PtCl$_2$,2NH$_2$OH,NH$_3$,C$_5$H$_5$N ;
trans-PtCl$_2$,NH$_2$OH,2NH$_3$,C$_5$H$_5$N ;
[Pt(NH$_2$OH)$_2$,NH$_3$,C$_5$H$_5$N]PtCl$_4$;
[PtNH$_2$OH(NH$_3$)$_2$,C$_5$H$_5$N]PtCl$_4$;
[PtNH$_2$OH,NH$_3$(C$_5$H$_5$N)$_2$]PtCl$_4$;
[Pt(NH$_2$OH)$_2$,NH$_3$,C$_5$H$_5$N]PdCl$_4$;
[PtNH$_2$OH(NH$_3$)$_2$, C$_5$H$_5$N]PdCl$_4$;
[PtNH$_2$OH,NH$_3$,(C$_5$H$_5$N)$_2$]PdCl$_4$.   L. J. J.

Physical phenomena of the arc discharge and their importance in spectro-analytical methods of investigation. W. ROLLWAGEN (Spectrochim. Acta, 1939, **1**, 66—81).—The physical processes in the arc discharge and the contributions of the cathode region and of the column to the radiation emitted are discussed. In the column there is practically a thermal equilibrium, the temp. being dependent on the ease of ionisation of the carrier vapour. This is illustrated by variations in the intensities of the Ca and Sr lines in different carrier vapours. The effects of the experimental conditions on the arc spectra are also discussed. Preliminary investigations are also described which indicate that Tl can be determined by using an interrupted arc discharge between C electrodes impregnated with Na salts, In being used as comparison element.   J. W. S.

Electro-titrations : review of recent trends. N. H. FURMAN (Trans. Electrochem. Soc., 1939, **76**, Preprint, 237—251).

Volumetric analysis. Cause of error often overlooked. Liquids should not be measured by volume. R. MEURICE (Ann. Chim. Analyt., 1939, [iii], **21**, 202—203).—Climatic variations in temp. such as may occur overnight may lead to surprisingly large changes in the vols. of liquids, with consequent errors in determinations. Analyses etc. by titration should therefore be carried out on weighed portions and the amount of liquid added should be found by weighing. Full manipulative details are given. The results are comparable with, or better than, those obtained by use of the micro-burette. Evaporation of aq. solutions during titration is negligible.   T. H. G.

Use of the antimony electrode for determining hydrogen-ion concentration. R. SPYCHALSKI (Rocz. Chem., 1939, **19**, 441—462).—Accurate and reproducible results are given by Sb electrodes in stirred systems, with exclusion of CO_2, when a const. relation between the surface of the electrode and the vol. of the solution is maintained. The temp. coeff.—p_H curve is given. Salts (NaCl, NaNO$_3$, Na$_2$SO$_4$, KNO$_3$) considerably modify the potential given by Sb electrodes, to a greater extent than for H electrodes. Gelatin and agar (3%) do not affect the results. Under conditions favourable for oxide formation the Sb electrode behaves as an irreversible electrode of the 2nd order, whilst under reducing conditions it behaves similarly to a Pt electrode.   R. T.

s-Diphenylguanidine as an acidimetric standard. J. W. YOUNG (Canad. J. Res., 1939, **17**, B, 192—197).—Three methods of preparing borax containing exactly 10H_2O have been compared. The H_2O content is always slightly low, and the material is not stable on keeping. NaHCO$_3$ can be kept for long periods without change. s-Diphenylguanidine is a satisfactory standard; it has F_4^{20} 1·19.   F. J. G.

Concentration cell in quantitative analysis. II. Determination of fluoride. G. W. LOW, jun., and E. H. PRYDE (J. Amer. Chem. Soc., 1939, **61**, 2237—2246).—The technique involved in the determination of Cl' by means of a simple concn. cell (cf. A., 1935, 1336) has been applied to the rapid and accurate determination of F' ions. The effect of other ions has been completely eliminated. The

method has been applied to the determination of F′ in H_2O and phosphate rock. W. R. A.

Detection of fluorine in minerals. F. C. FOLEY and P. W. WEST (Amer. Min., 1939, 24, 398—399).— The fading of the Zr–alizarin lake is utilised after fusion of the sample with Na_2CO_3 in a Pt loop, dissolution in 1 : 1 HCl, and dilution with H_2O. Large amounts of $SO_4″$, $AsO_4‴$, and $S″$ interfere, and in presence of PO_4 the fused mass must be dissolved in 1 : 1 H_2SO_4 and any F removed by distillation. L. S. T.

Determination of fluorine in wine.—See B., 1939, 983.

Determination of oxygen in metals.—See B., 1939, 952.

Rapid determination of sulphuric and hydrochloric acids in presence of each other by means of conductometric neutralisation analysis. K. ŠANDERA and E. SOMMER (Z. anal. Chem., 1939, 117, 265—268).—The mixture of HCl and H_2SO_4 is diluted to 0·05—0·25N. and 10 c.c. of this solution are titrated (phenolphthalein) with 0·1N-$Ba(OH)_2$, giving the total acidity. The titrated solution is diluted accurately to 100 c.c. and its conductivity is determined without previous filtration. Reference to a graph or to the table reproduced gives the [HCl]. L. S. T.

Determination of sulphur in titaniferous coal ash. Precipitation of barium sulphate in presence of titanium salts.—See B., 1939, 900.

Determination of sulphur in ferro-phosphorus. —See B., 1939, 944.

Determination of volatile sulphur compounds in foods.—See B., 1939, 988.

[Determination of] selenium. R. A. OSBORN (J. Assoc. Off. Agric. Chem., 1939, 22, 346—349).— On the basis of satisfactory collaborative analyses it is recommended that the simplified procedure described previously be tentatively adopted (cf. A., 1938, I, 471). E. C. S.

Conductometric analysis of sodium selenite and mercurous nitrate. J. KAMECKI (Rocz. Chem., 1939, 19, 433—440).—Good results are obtained in the electro-titration of Na_2SeO_3 with $HgNO_3$; the reverse titration is best effected in presence of HNO_3. R. T.

Kjeldahlisation in laboratories not equipped with well ventilated fume cupboards. A. ERNEST (Chem. Listy, 1939, 33, 225—226).—The fumes are aspirated through aq. NaOH. R. T.

Determination of nitrogen in stainless steels. —See B., 1939, 945.

Ferro-molybdate reagent for the detection of small quantities of phosphoric acid, silicic acid, arsenic acid, and arsenious acid. J. H. VAN DER MEULEN (Rec. trav. chim., 1939, 58, 841—846).— Under suitable conditions of concn. and p_H, a solution of $FeSO_4$ and Na_2MoO_4 in dil. H_2SO_4 remains colourless, but is coloured blue by traces of H_3PO_4, H_2SiO_3,

H_3AsO_4, or H_3AsO_3. No reaction is given with $H_4P_2O_7$. The presence of F′ is advantageous. F. J. G.

Determination of phosphate by photo-electric colorimetry. G. R. SMITH, W. J. DYER, C. L. WRENSHALL, and W. A. DE LONG (Canad. J. Res., 1939, 17, B, 178—191; cf. A., 1938, I, 369).—The effects of the concn. of $Sn^{··}$ and $Sn^{····}$, of other salts, of $Fe^{···}$, and of temp. on the reaction have been studied. The $SnCl_2$ solution must be protected against oxidation. The interference by $Fe^{···}$ can be reduced by dilution of the solution and by the use of a larger concn. of $Sn^{··}$. F. J. G.

Application of salts of complex cations to the microscopic detection of anions. VIII. 1 : 2-Chloroaquotetramminocobaltic chloride. L. K. YANOWSKI and W. A. HYNES (Mikrochem., 1939, 27, 161—164).—The reagent has been prepared by a modification of Werner's method (A., 1908, ii, 42). Cryst. products are obtained with $HPO_4″$ and $P_2O_7⁗$ ions, the min. amounts detactable by the method being 67 and 200 μg., respectively. With $HPO_4″$ the form of the product depends to some extent on the p_H of the solution. Other ions which give turbidities with the reagent are listed. J. W. S.

Spectrophotometric determination of phosphoric acid by means of the cœruleo-molybdic reaction.—See A., 1939, III, 886.

Rapid volumetric micro-method for determining arsenic. C. C. CASSIL and H. J. WICHMANN (J. Assoc. Off. Agric. Chem., 1939, 22, 436—445).— The method, which is suitable for apple strip solutions, or for material submitted to wet digestion, is described in greater detail than in the previous account (cf. A., 1938, I, 471). With 5—500 μg. of As_2O_3 the recovery of As is 99·5%, standard deviation 0·85%. The determination requires <10 min. E. C. S.

Determination of carbon dioxide content of ammoniacal liquors.—See B., 1939, 935.

Colorimetric determination of carbon disulphide [in benzoles].—See B., 1939, 903.

Determination of silicon [in light alloys].—See B., 1939, 951.

Microchemical detection of certain cations with the aid of hexanitrodiphenylamine. O. G. SCHEINTZIS (Chimia, 1936, 103—111).—2% aq. $NH[C_6H_2(NO_2)_3]_2$ gives characteristic micro-crystals with K ($\not< 0·012$N.; NH_4 interferes, but not Na, Li, Mg, Ba, Sr, or Ca, whilst Al, Fe^{III}, Cr^{III}, Ni, Co, Bi, and Hg^I give amorphous ppts.), with Cs ($\not< 0·0005$N.), with Rb ($\not< 0·0015$N.), with Pb^{II} ($\not< 0·0015$N.), and with Hg^{II} ($\not< 0·002$N.). R. T.

Determination of total and free alkali in sodium stannate solutions.—See B., 1939, 935.

Drop tests for some ions. E. A. KOCSIS (Mikrochem., 1939, 27, 180—184).—In drop reactions with neutral solutions benzopurpurin 4B yields a brown ring and red central spot with $Ag^·$ ($\not< 0·03$ mg.), a red-violet spot with $Hg_2^{··}$ ($\not< 0·04$ mg.), a bluish-grey ring and violet-red inner spot with $Hg^{··}$ ($\not< 0·025$ mg.), a bright brown ring and reddish-yellow centre spot with $UO_2^{··}$ ($\not< 0·035$ mg.), and a reddish-brown

spot with Al$\cdots$ ($\not<$0·005 mg.). Bromophenol-blue yields a sharp violet-red ring and violet spot with Pb ($\not<$0·025 mg.), a reddish-brown spot with Hg$_2\cdot\cdot$ ($\not<$0·015 mg.), an ochre-yellow spot and bright blue outer ring with Hg$\cdot\cdot$ ($\not<$0·02 mg.), and a red-brown ring with UO$_2\cdot\cdot$ ($\not<$0·025 mg.). Al ($\not<$0·001 µg.) can be detected by treating the test solution with a drop of morin (in EtOH) and irradiating with an ultra-violet lamp, when a bright green fluorescence is obtained in transmitted light.   J. W. S.

Micro-determination of calcium and phosphate. R. S. MANLY (Mikrochem., 1939, **27**, 145—153).—Tables are given summarising methods for determining $\gg$1 mg. of Ca and P. The wt. of constituent determined, special reagents and apparatus used, and the principles, use, accuracy, and precision of the methods are summarised.   J. W. S.

Winkler's semi-microchemical analytical method in technical analysis. V. MAJER and J. MACEK (Chem. Obzor, 1939, **14**, 53—55).—Winkler's method for the determination of Ca$\cdot\cdot$, SO$_4''$, Pb$\cdot\cdot$, and PO$_4'''$ requires experience, and is of use only for a series of determinations.   F. R.

[Determination of] zinc. E. B. HOLLAND and W. S. RITCHIE (J. Assoc. Off. Agric. Chem., 1939, **22**, 333—339).—The dithizone method has been modified in numerous details and extended to permit determination of Cu and Pb. The full procedure is described and the colour reactions of 28 metals with dithizone, NEt$_2\cdot$CS$_2$Na, and a mixture of the two reagents, in both 0·02N-HCl and 0·02N-NH$_3$ in every case, are tabulated.   E. C. S.

Determination of cadmium, and its separation from bismuth, by means of potassium iodide and hydrazine hydrate. A. JÍLEK and B. KOHUT (Chem. Listy, 1939, **33**, 252—256).—10 c.c. of 10% KI are added to 100 c.c. of hot solution, containing $\gg$0·2 g. Cd, followed by 10 c.c. of 10% N$_2$H$_4$,H$_2$O, and the ppt. of CdI$_2$,2N$_2$H$_4$ is collected, washed (special solution), dried at 110°, and weighed. In presence of Bi ($\gg$0·1 g. each of Cd and Bi in 150 c.c.), 8 c.c. of 2N-NH$_4$NO$_3$ and 40 c.c. of neutral 10% Na tartrate are added, followed by 35 c.c. of 10% KI, and 30 c.c. of 10% N$_2$H$_4$,H$_2$O are added gradually to the hot solution. The ppt. separating from the cooled solution is washed (special solution), dried, and weighed. Bi is determined in the filtrate, by the usual methods.   R. T.

[Polarographic] determination of cadmium in blende.—See B., 1939, 947.

Absolute colorimetric metal analysis.—See B., 1939, 952.

Determination of small amounts of lead in presence of copper, iron, and tin. J. P. GOCHSCHTEIN (Chimia, 1936, 127—132).—Pb is pptd. as PbCr$_2$O$_7$, the washed ppt. is dissolved in conc. HCl, 10% KI is added, and I is titrated with 0·01N-Na$_2$S$_2$O$_3$. Fe interferes, and should be removed, together with Cu, by pptn. with excess of KOH. The filtrate + washings are made acid with AcOH, and Pb is determined by the above method (12—30 mg.-%).   R. T.

(A) Micro-titration of lead. M.V. GAPTSCHENKO. **(B) Determination of lead in alloys.** M. V. GAPTSCHENKO and O. G. SCHEINTZIS (Chimia, 1936, 113—118, 119—125).—(A) 10% NaHSO$_3$ is added to the solution ($\not<$0·05 mg. Pb) in a centrifuge tube, and the ppt. of PbSO$_3$ is washed on the centrifuge and dissolved in 2N-NaOH. I in KI is added, the solution is made acid, and excess of I is titrated. Fe and Cu do not interfere in neutral solutions.

(B) The alloy, containing Sn, Sb, Pb, and Cu, is dissolved in HNO$_3$, the solution is filtered, excess of aq. NH$_3$ is added to the filtrate, the ppt. of Pb(OH)$_2$ is dissolved by adding NH$_4$OAc, and Pb is determined by the above method.   R. T.

Determination of free lead oxide in red lead. —See B., 1939, 966.

Determination of lead tetraethyl in gasoline. —See B., 1939, 904.

[Determination of] copper. D. L. DRABKIN (J. Assoc. Off. Agric. Chem., 1939, **22**, 320—333).—The dithizone method is improved in respect of ashing of the sample, the use of a new solvent, viz., iso-C$_5$H$_{11}\cdot$OAc, and the use of several monochromatic filters for the photometry of the coloured solution. Procedures are given for ashing samples of milk, elixirs, and animal tissues. The absorption spectra of the Cu, Ni, Co, and Bi dithizone complexes and of CuSO$_4$,4NH$_3$,H$_2$O are reproduced. Three filters of which the max. transmissions are at 640, 535, and 480 mµ., respectively, are specified and recommended for this and other photometric determinations. The separation of Cu from Ni and Co and the correction for contamination with Bi are discussed.   E. C. S.

Thiolbenziminazole as an analytical reagent. M. KURAŠ (Chem. Obzor, 1939, **14**, 51—52).—Cu$\cdot\cdot$, Cd$\cdot\cdot$, and Pb$\cdot\cdot$ may be determined by pptn. with thiolbenziminazole. Pb$\cdot\cdot$ and Cd$\cdot\cdot$ may be weighed directly as the ppts. C$_7$H$_5$N$_2$SPbOH and C$_7$H$_5$N$_2$SCdOH,NH$_3$ respectively, but the Cu$\cdot\cdot$ ppt. must be converted first by ignition into CuO.   F. R.

Determination of copper [in duralumin-type alloys].—See B., 1939, 950.

[Determination of] mercury. W. O. WINKLER (J. Assoc. Off. Agric. Chem., 1939, **22**, 341—346).—Tests of various methods of proceeding after extraction with dithizone are recorded, none of them leading to final conclusions.   E. C. S.

Microchemical detection of mercury. I. M. KORENMAN (Chimia, 1936, 133—135).—Equal vols. of saturated aq. ZnSO$_4$ and NH$_4$CNS are mixed, H$_2$O is added to dissolution of the ppt. of Zn(CNS)$_2$, and 0·1 g. of Fe alum is dissolved in the solution. The reagent gives characteristic crystals of HgZn(CNS)$_4$ with Hg^I or Hg^{II} (0·023 µg.), Cd (0·25 µg.), or Ag (0·4 µg.). Cu, Pb, Ba, and Sr interfere with the reactions, but not Sb, Sn, Bi, Mn, Fe, Co, or Ni.   R. T.

Separation of praseodymium and terbium from mixtures of rare earths. G. BECK (Angew. Chem., 1939, **52**, 536—537).—To remove Pr and Nd the rare earth mixture is fused with KOH; electrolysis of the product gives brown PrO$_2$ at the anode and

metallic Nd at the cathode; decantation when the reaction is complete leaves a residue of PrO_2, whilst hydrolysis of the $KNdO_2$ melt yields $Nd(OH)_3$ which is further extracted with 10% AcOH. The removal of Tb from Sm–Gd fractions is also based on fusion of the material with KOH, but with addition of $KClO_3$; impure TbO_2 is pptd. on cooling and the process is repeated.   S. M.

Determination of very small amounts of europium in samarium. A. GATTERER and J. JUNKES (Spectrochim. Acta, 1939, 1, 31—46).—The Sm_2O_3 (0·05 g.) is dissolved in HCl (0·5 c.c.) and examined spectroscopically by a modified form of Scheibe and Rivas' method (A., 1936, 1084), a definite vol. of the solution being absorbed on the pure C electrodes after definite periods of operation of the arc. The intensities of the Eu 4129·73 and 3971·95 A. lines are compared with those of the Sm 4128·10 and of the 2971·35 and 3970·53 A. lines, respectively. The [Eu] is then deduced by comparison with the results of tests with solutions of similar [Sm] containing known [Eu]. The same standard solutions can be used to determine approx. the [Eu] in Gd by abs. intensity measurements. The method permits the determination of 0·01% of Eu in Sm with an accuracy of ±5%.   J. W. S.

Application of emission spectroscopy to local micro-analysis. I. (a) Apparatus. (b) Preliminary results. G. SCHEIBE and J. MARTIN (Spectrochim. Acta, 1939, 1, 47—65).—An electric discharge is produced between a rod electrode, contained in a tube terminating in a capillary jet, and a metallic surface in such a manner that the excited spot of the latter is of diameter ⊅0·02 mm. Such a discharge permits the detection of local variations in the composition of the surface. By simultaneous movement of the surface and of the photographic plate a spectrogram can be obtained which indicates the composition of an alloy at all points along the line tested. The applicability of the method is discussed with reference to results obtained with Al alloys.   J. W. S.

Determination of aluminium in steel.—See B., 1939, 945.

Potassium chlorate with sodium hydroxide as a dry reagent for manganese. G. DENIGÈS (Bull. Trav. Soc. Pharm. Bordeaux, 1936, 74, 148—152; Chem. Zentr., 1937, i, 1985).—0·2—0·25 g. of $KClO_3$ is treated with 1—2 drops of aq. NaOH, dried, and fused until gas bubbles appear. This reagent gives a green or blue-green bead on fusion in presence of Mn; the bead gives a green aq. solution, which becomes pink on addition of HNO_3. Cu, Co, and Ni also give green beads.   A. J. E. W.

Colorimetric determination of ferrous and ferric iron in presence of aluminium, manganese, zinc, mercury, copper, phosphoric acid, or of organic substances, with special regard to medicinal preparations. E. SCHULEK and I. FLODERER (Z. anal. Chem., 1939, 117, 176—195).—The application of the 2 : 2'-dipyridyl (I) method to the determination of Fe in presence of certain metals, org. substances, and in Fe-containing medicines has

been investigated, using the Pulfrich photometer. Extinction data show that with a suitable light filter (S50) and conditions the colour of Fe·· with (I) obeys Beer's law, and that a tenfold excess of Al, Mn, Zn, Hg, Cu (in presence of KCN), and Fe··· (in presence of H_3PO_4) does not interfere with the determination of 50 and 100 μg. of Fe·· per 100 c.c. by this method. Fe··· can be determined as the Fe··–(I) complex after reduction to Fe·· with a slight excess of H_2SO_3 by warming in slightly acid solution. In presence of H_3PO_4 reduction is incomplete under these conditions, but can be made complete by adding (I) during reduction, buffering with NH_4OAc, and keeping for ⊀24 hr. With > a 1000-fold excess of H_3PO_4 only 50 μg. of Fe can be reduced completely. Details for the determination of Fe··, and of Fe··· in presence and absence of H_3PO_4, are given. Amounts of Cu > a 10-fold excess must be removed as CuCNS. H_3PO_4 is an efficient stabiliser in the determination of Fe·· in liquid medicinal preps., and solid preps. are dissolved in 20% H_3PO_4 and 38% HCl. The total Fe in org. materials and medicinal preps. containing them can be determined by the (I) method without prior destruction of the org. matter. The sample is warmed with dil. H_2SO_4, reduced with H_2SO_3, and then treated with (I) and NH_4OAc. Details of the various methods and typical results for a no. of medicinal preps. are given. Purification of the reagents from Fe is also described.   L. S. T.

Spectrum analysis of solutions containing metals. P. JOLIBOIS and R. BOSSUET (Compt. rend., 1939, 209, 91—93).—Limiting concns. for the detection of 21 metals by the authors' technique (A., 1937, I, 374) are given. Solutions containing Fe give lines due to the neutral atom, and lines of non-metals, rare-earth metals, Nb, Ta, etc. cannot be obtained, confirming that the spectra are due to combustion of OH under the surface of the solution (cf. A., 1939, I, 29).   A. J. E. W.

Photometric determination of iron and copper in aluminium and aluminium alloys.—See B., 1939, 949.

Potentiometric analysis of ferrovanadium.—See B., 1939, 944.

Potentiometric analysis of ferrotitanium.—See B., 1939, 944.

Determination of cobaltihexacyanide. L. GUZELJ (Bull. Soc. Chim. Yougoslav., 1938, 9, 185—200).—The solubility of $Ag_3Co(CN)_6$ (I) in H_2O at room temp. is ~10^{-6} g.-mol. per l. $Co(CN)_6'''$ is determined gravimetrically by pptn. of (I) with a small excess of $AgNO_3$, or volumetrically by titration with $AgNO_3$. Potentiometric titration with $AgNO_3$ gives low results, owing to adsorption of $Co(CN)_6'''$ on the pptd. (I).   R. T.

Determination of tin and copper in bronzes.—See B., 1939, 946.

Tin–phosphorus precipitate in bronze analysis.—See B., 1939, 946.

Volumetric and gravimetric determination of zirconium and hafnium, alone and in presence of each other, with selenious acid. A. CLAASSEN

(Z. anal. Chem., 1939, **117**, 252—261).—The dil. acid solutions containing Zr or Hf are treated with excess of aq. H_2SeO_3 (cf. A., 1931, 590) and the pptd. basic salts converted into $Zr(SeO_3)_2$ or $Hf(SeO_3)_2$ by long digestion (5—20 hr.) on the water-bath. The ppts. can be either dried at 120—200° and weighed as selenites, or dissolved in aq. $NaF + dil. H_2SO_4$, and the H_2SeO_3 determined iodometrically by van der Meulen's method (A., 1934, 744). The volumetric results for Zr are accurate, but for Hf they are 1·0—1·4% high, and the gravimetric results for Zr are high owing to a slight reduction of SeO_3'' to Se. By combining a determination of mixed oxides, $ZrO_2 + HfO_2$, with the volumetric determination as selenites, the Hf content in a mixture of the two metals can be found with an accuracy of ∼1%.   L. S. T.

Analysis of slags containing vanadium.—See B., 1939, 944.

Rapid determination of traces of bismuth in lead.—See B., 1939, 948.

Colour reactions of polyphenols with niobium and tantalum salts. N. F. KRIVOSCHLIKOV and M. S. PLATONOV (J. Gen. Chem. Russ., 1939, **9**, 539).—Polemical, in reply to Schemjakin *et al.* (A., 1939, I, 102) and to Zvjagintzev *et al.* (*ibid.*, 102).   R. T.

Colorimetric determination of palladium with p-nitrosodiphenylamine. J. H. YOE and L. G. OVERHOLSER (J. Amer. Chem. Soc., 1939, **61**, 2058—2063).—p-NO·C_6H_4·NHPh (I) reacts with $PdCl_2$ in neutral or slightly acid solution to give either a deep red coloration or a purplish-brown ppt. of $Pd[NHPh·C_6H_4·NO]_2Cl_2$ (II), depending on the [Pd]. The test is extremely sensitive and will detect 1 part Pd in 2×10^8. Au and Ag give colours but the sensitivity is ≪ for Pd. Oxidising agents interfere; cyanides and iodides prevent the reaction. The sensitivity is influenced by p_H and by presence of salts. Absorption curves for (I) and (II) are given. The determinations of Pd in presence of Au and of Pt are outlined.   W. R. A.

Micro-determination of rhodium with thionalide. H. KIENITZ and L. ROMBOCK (Z. anal. Chem., 1939, **117**, 241—243).—The chloride-free Rh solution (30—50 c.c. containing 0·25—10 mg. of Rh) is treated with an excess of 1—2% thionalide (I) in glacial AcOH. The orange-yellow ppt. of $Rh(C_{12}H_{10}ONS)_3$ produced on boiling is filtered hot, washed with glacial AcOH, and the excess of (I) in the filtrate is titrated with I, a small excess of which is back-titrated with $Na_2S_2O_3$. Since $RhCl_3$ gives a ppt. of ∼ $Rh(C_{12}H_{10}ONS)_3, RhCl_3$, Cl' must be removed by evaporation with H_2SO_4. The results are accurate to <1%.   L. S. T.

Hydrocarbon flame temperatures. J. VAN DE POLL and T. WESTERDIJK (Compt. rend., 1939, **209**, 158—160).—A modified Féry method of measuring high flame temp. (θ) is described. A continuum afforded by a C arc is superposed on the D-lines produced by the flame, and the luminosities are matched by adjustment of an absorption trough in the arc optical system. The colour temp. of the arc image is then determined with a pyrometer. Accuracy to within 5° is claimed. θ vals. for C_3H_8-O_2 flames are

in accord with vals. calc. by Ribaud's method (B., 1938, 124), except when the O_2 is insufficient for complete combustion, when $\theta_{obs.}$ is > $\theta_{calc.}$, owing to interference by the secondary combustion zone. The efficiency of a welding flame is determined by the proportion of the evolved heat which represents primary combustion (35 and 75% with C_2H_2 and C_3H_8), the heat of secondary combustion being of no val.   A. J. E. W.

Liquefaction of helium. A. VAN ITTERBEEK [with W. VAN DINGENEN] (Physica, 1939, **6**, 728—736; cf. A., 1939, I, 339).—A He liquefier-cryostat, based on the liquefier already described, has been constructed. The apparatus uses 3 l. of liquid H_2, with initial pressure 80—100 atm. and temp. 14° K. The expansion operation gives 25—30 c.c. of liquid He, the time required being 0·75 hr. 50% of the He liquefied can be obtained in the cryostat.   L. J. J.

Survey of the durability of aluminium-coated mirrors in astronomical use. R. C. WILLIAMS (Astrophys. J., 1939, **89**, 611—622).—The chief cause of deterioration is the combined action of deposits of chemically-active dust and H_2O.   L. S. T.

Absorption factor in crystal spectroscopy. G. ALBRECHT (Rev. Sci. Instr., 1939, **10**, 221—222).—A graphical method for determining the absorption in a crystal of any size, shape, and absorbing power is described.   D. F. R.

Cylindrical lens spectrograph for the optical determination of the concentration of ozone in atmospheric layers near the ground. M. W. CHIPLONKAR (Proc. Indian Acad. Sci., 1939, **9**, A, 504—507).—The spherical camera lens of the objective prism spectrograph is replaced by a cylindrical lens with its axis parallel to the refracting edge of the prism, and an optical wedge of known consts. is added near the photographic plate with the slope of the wedge parallel to the length of the spectral lines. The application of the instrument and the method of calculating the amount of O_3 are outlined.   C. R. H.

Conoscopic determination of the position of the binormals in a triclinic crystal, without knowledge of the n_β index. A. SWARYCZEWSKI (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 1—7; Chem. Zentr., 1937, i, 1372).—The axes are determined by Wülfing's method, using the measured angles between the optic axes and the normals for two crystal faces, and plotting these angles in a spherical triangle. An example is given.   A. J. E. W.

Apparatus for demonstrating X-ray fluorescence and phosphorescence. M. LENZI (Strahlenther., 1939, **65**, 158—162).   E. M. J.

Photography of interatomic distance vectors and of crystal patterns. M. J. BUERGER (Proc. Nat. Acad. Sci., 1939, **25**, 383—388).—Suggestions for extending the range of application of Bragg's X-ray microscope (A., 1939, I, 389) are made.   W. R. A.

Vertical illuminator for low-magnification photography of polished surfaces. J. A. LEGGE, jun. (Amer. Min., 1939, **24**, 400—403).   L. S. T.

Photo-counters in the ultra-violet. A. DAUVIL-LIER and E. VASSY (Compt. rend., 1939, **209**, 394—397).—λλ (2000—3500 A.) of the upper and lower sensitivity (s) limits and the s max. are given for counters with variously treated Cu, Ag, Au, C, Ni, Mo, and Pt photo-cathodes in Kr and H_2. Treatment of the cathode with H_2 at 300°, or bombardment with H^+ ions, displaces the s curve to higher λλ. High s at 200—400 A. is produced by using cathodes heat-treated with O_2, and a rare gas filling containing 0·1% of O_2. The construction of the counters, which are stable and give reproducible results, is outlined.
A. J. E. W.

Photo-electric photometry. Photo-emissive cell specially designed for high precision measurements. G. A. BOUTRY and P. GILLOD (Phil. Mag., 1939, [vii], **28**, 163—184).—The construction of a photo-emissive cell which gives a strictly proportional response over a large register of luminous flux variation is described. The cell has finite plane parallel electrodes with guard-rings, one electrode being transparent for the admission of light. This approximates to an ideal cell with infinite parallel plane electrodes. A much lower tension is employed than with most commercial cells and as a result the " noise-level " is extremely small when an amplifier is used. The cell has a low saturation potential (~0·1 v.) and a space-charge sufficiently small for current–potential characteristics to be quite straight and horizontal between saturation and the first excitation potential of the residual gas in the cell.
C. R. H.

Two examples of the non-additivity of the photo-electric effects of simultaneous luminous fluxes. G. LIANDRAT (Compt. rend., 1939, **209**, 101—103).—The effect of an intense continuous flux on the current variation produced by a superimposed alternating flux in " thalofide " and Se cells is studied and discussed (cf. Schönwald, Ann. Physik, 1932, **15**, 419).
A. J. E. W.

Photo-electric diffusion–absorption meter. A. DOGNON (Compt. rend. Soc. Biol., 1939, **130**, 1481—1484).—An apparatus to measure diffusion and absorption of systems absorbing feebly is described.
H. G. R.

Dispenser cathode. New type of thermionic cathode for gaseous discharge tubes. A. W. HULL (Physical Rev., 1939, [ii], **56**, 86—93).—Decrease in high electron emission with time of operation is eliminated by the use of initially un-coated cathode members to which a coating material is dispensed at uniform rate from a " dispenser " located within the common heat-shield. The dispenser consists of a closely woven structure of fine Mo wires, filled with granules of fused $BaO–Al_2O_3$ eutectic. It is maintained at 1150° by current through it, and serves as a radiation heater for the cathode. The electron-emitting members are clean Mo.
N. M. B.

Performance of the 60-inch cyclotron at the University of California. E. O. LAWRENCE et al. (Physical Rev., 1939, [ii], **56**, 124).—An outline of initial adjustments and results.
N. M. B.

Detection of radioactive contamination, using Geiger–Müller counters. L. F. CURTISS (J. Res.

Nat. Bur. Stand., 1939, **23**, 137—150).—A portable Geiger–Müller counter operated entirely from a.c. mains and capable of rapid and accurate detection of radioactive material equiv. to 0·5 μg. of Ra per sq. m. is described. The instrument is suitable for detection of contamination by radioactive materials and for routine testing of workers, their garments, and materials handled by them. It can also be used for testing Ra ores and detecting lost Ra preps.
J. W. S.

Investigation of the linear accelerator. P. L. HARTMAN and L. P. SMITH (Rev. Sci. Instr., 1939, **10**, 223—231).—A linear resonance accelerator giving $3·5 \times 10^5$ e.v. is described. A theoretical discussion of the yield and velocity distribution of the particles and of focussing and high-frequency problems is included. The mass selection of the linear accelerator is not sufficient to separate cleanly ions of all masses.
D. F. R.

Fog in Wilson cloud chambers. (MISS) N. M. MOHLER and (MISS) P. L. MORROW (Rev. Sci. Instr., 1939, **10**, 242—243; cf. A., 1939, I, 390).—The fog density shows a max. at low light intensities, followed by a sharp increase at high intensities. No such effect is observed with yellow light. The fog increases with time. Variation in expansion rate, substitution of different alcohols, or removal of velvet in the chamber produces no appreciable change in the amount of fog.
D. F. R.

Automatic registration of the course of chemical reactions. K. ŠANDERA (Chem. Obzor, 1939, **14**, 89—90).—If a chemical change can be transformed into changes of electrical current (conductivity, photo-cells, thermocouples, etc.) it can be automatically registered. Examples are described.
F. R.

Simple arrangement for measuring specific resistance of liquids. V. NESSEL (Chem. Obzor, 1939, **14**, 137—139).—The problem of simple conductivity measurement depends on a suitable electrode and current-measuring instrument. Satisfactory apparatus for these two requirements is described in detail.
F. R.

Mounting for the antimony electrode. G. FLORENCE and A. DRILHON (Arch. Phys. biol., 1936, **13**, 113—114; Chem. Zentr., 1937, i, 2221).
A. J. E. W.

Sector process for photographing electron interference. P. DEBYE (Physikal. Z., 1939, **40**, 507—508).—It is shown that no improvement can result when plates already taken are copied by a sector process, but that the rotating sector must be used in front of the actual plate on which the original photograph is taken.
A. J. M.

Intensity problems and resolving power of the electron microscope. M. VON ARDENNE (Z. Physik, 1939, **112**, 744—752).—The mutual dependence of image brightness and c.d. at different parts of the electron-optical train, and their relation to the resolving power of the electron microscope, are examined theoretically.
H. C. G.

Magnetic operation of chemical balances. J. P. BLEWETT (Rev. Sci. Instr., 1939, **10**, 231—233).—

The use of a magnetic force for measuring small wts. is applied to an analytical and a vac. balance. The method is particularly suitable for measuring small changes of wt. in a vac.   D. F. R.

Use of Hempel's gas pipette with four bulbs. L. WOLF (J. pr. Chem., 1939, [ii], **153**, 263—264).— A modified pipette, which can be readily filled and in which the Cu gauze is replaced by a bundle of clean Cu wires, is described.   H. W.

Simple inexpensive pipetting machine. J. H. MILLS (J. Lab. clin. Med., 1939, **24**, 1082—1084).   C. J. C. B.

Apparatus for determining surface tension and elasticity. A. DOGNON and M. ABRIBAT (Compt. rend. Soc. Biol., 1939, **130**, 1000—1002).—The method described employs electromagnetic compensation to measure the force exerted on a Pt lamina roughened with emery.   H. G. R.

Method of counting [dust] samples taken with the impinger. C. R. WILLIAMS (J. Ind. Hyg., 1939, **21**, 226—230).—The new procedure employs an eye-piece of higher magnification than in the standard method, and a bright-line hæmocytometer cell. The results obtained agree with those determined by the standard method, and the process is more rapid and eliminates glare.   E. M. K.

Determination of rate of evaporation of liquids. R. S. DANTUMA (Verfkroniek, 1939, **12**, 110—111).—The left-hand pan of a balance is replaced by a ring to which is fixed a filter-paper, and wts. are placed on the right-hand pan to secure a balance. A number of 50-mg. wts. are now placed on the pan to make a wt. slightly $<$ that of 1 ml. of the liquid under test. 1 ml. of the liquid is then run on to the filter-paper from a pipette and the time when a balance is obtained is noted. One 50-mg. wt. is then removed and the time for balance to be restored by evaporation of the liquid is noted. The process is repeated until all the liquid has evaporated. From the readings, a curve showing the rate of evaporation is plotted.   D. R. D.

Rideal absorption hygrometer. H. W. HARKNESS (Rev. Sci. Instr., 1939, **10**, 237—241).—The errors due to adsorption on the containing walls of the hygrometer, presence of stagnant air, and temp. fluctuations have been studied theoretically and experimentally. By applying corrections for the first two errors and employing the hygrometer in a thermostat, very reliable determinations may be made.   D. F. R.

Portable motor-driven apparatus for depositing built-up molecular films. S. J. GREGG and E. E. WIDDOWSON (Rev. Sci. Instr., 1939, **10**, 236—237).   D. F. R.

Mounting thin celloidin sections. G. G. ROBINSON (J. Roy. Microscop. Soc., 1939, [iii], **59**, 79).— Sections 3 μ. in thickness, and difficult to flatten, were floated in H_2O on slides previously smeared with albumin. After stretching on the hot-plate, the ribbons were put for some hr. in a closed glass vessel containing cotton-wool soaked in Et_2O and a dish of

$CaCl_2$. These, respectively, flattened and dried the sections, which could be thus stored indefinitely.   N. M. B.

Determination of mol. wt. by an ultra-centrifuge method, without an observation system. M. PAIĆ (Arh. Hemiju, 1939, **13**, 33—41).—The use of the ultra-centrifuge of Henriot and Huguenard for mol. wt. determination is described.   R. T.

Extension of the method of determination of mol. wts. by depression of the freezing point. W. PRAHL (Angew. Chem., 1939, **52**, 481—484).— Mol. wt. determinations are possible using solutions of concn. such that a depression of f.p. of 10—30° is obtained, a thermometer graduated in 0·1° being used. The mol. wt., M, is calc. from $M = M_s c / (m - 1)100$, where M_s is the mol. wt. of the solvent, c the concn. of dissolved material in g. per 100 g. of solvent, m is the reciprocal of the mol. fraction and is calc. from $\log_{10} m = K_m \Delta / T_0 T$, Δ being the observed depression, T_0 the f.p. of the solvent and T the f.p. of the solution, both in ° K., $K_m = 0·21375L$, where L is the latent heat of fusion per g.-mol. of solvent.   F. H.

[Vacuum filter apparatus.] A. SCHWEIZER (Chem. Weekblad, 1939, **36**, 578).—A filter funnel is fitted into a double-chambered receiver, the two chambers of which can be evacuated, interconnected, separated from each other, or filled with air by means of glass taps. The apparatus is similar in principle to the Perkin triangle used in vac. distillations.   S. C.

Filter apparatus for filtration and washing of precipitates on a microscope slide. H. JURÁNY (Mikrochem., 1939, **27**, 185—188).—The filter comprises a glass tube, 2 cm. long and 1·5—2 mm. in diameter, constricted at two points. Between these points the tube is packed with asbestos with layers of fritted glass granules on each side. This tube is connected by rubber with the constricted end of a vertical tube, 8 mm. wide, which acts as filtrate receiver and the upper end of which is connected through a tap with a vac. pump. The device permits washing of a ppt. on a microscope slide, collection of the filtrate, and subsequent re-dissolution of the ppt. from the filter.   J. W. S.

Handling of small amounts of precipitate. J. DONAU (Mikrochem., 1939, **27**, 189—194).—An improved form of the author's filter (A., 1932, 828) is constructed of sheet Pt with spongy Pt as filtering medium. Methods of using the filter in conjunction with a shallow Pt pptn. dish for small amounts of liquid, and with a tap funnel pptn. vessel for larger quantities of liquid, are described.   J. W. S.

Preparation of membranes for ultralfitration. P. GRABAR and J. A. DE LOUREIRO (Ann. Inst. Pasteur, 1939, **63**, 159—189).—A detailed account of the prep. and chemistry of graded collodion membranes.   G. P. G.

Properties of membranes for ultrafiltration prepared on [Jena glass] funnels. A. BAUDOUIN and J. LEWIN (Compt. rend. Soc. Biol., 1939, **130**, 879—882).—Details are given for the prep. of collodion membranes for use in the apparatus previously de-

scribed (A., 1939, 1, 434). The membranes have a varying permeability which is decreased by ageing and heat.
H. G. R.

Additional device for avoiding sucking back with the Parnas–Wagner micro-Kjeldahl apparatus. P. E. LINDAHL (Mikrochem., 1939, **27**, 195—196).—The device comprises a wide U-tube, closed at one side by a stopper carrying a narrower tube which terminates immediately below the stopper and is connected through a pinchcock, kept open during use, with the intermediate tube of the Parnas–Wagner apparatus. The other side of the U-tube is connected to a narrower tube, 100 cm. long, which passes to the bottom of the U-tube and is closed at the top by an S-shaped bulb-tube containing dil. H_2SO_4. During use the bottom of the U-tube is filled with distilled H_2O and serves to effect equalisation of pressure during the steam-distillation. To facilitate emptying, the U-tube also carries a side arm, closed by a pinchcock. J. W. S.

Distillation apparatus for determination of nitrogen in small amounts. M. NEDVĚD (Klin. Woch., 1939, **18**, 912).—An apparatus for use in a micro-Kjeldahl method, applicable to series determinations, is described. E. M. J.

Purification of Clerici's solution and acetylene tetrabromide. K. RANKAMA (Bull. Comm. géol. Finlande, 1936, **9**, 65—67; Chem. Zentr., 1937, i, 2343).—Clerici's solution is freed from brown decomp. products of malonic acid by treatment of the hot liquid, diluted to four vols., with 1 g. of wood C per 100 g. of conc. solution. Tl is pptd. from the filtrate as TlCl, which is converted successively into Tl_2SO_4, TlOH, and Tl_2CO_3, and used for the prep. of new solution. $C_2H_2Br_4$ is diluted with C_6H_6 and treated with C. A. J. E. W.

Nomogram for titration of carbonates. I. W. ARBATSKY (Z. anal. Chem., 1939, **117**, 261—264).—A nomogram for obtaining the necessary corrections in the titration of carbonates using phenolphthalein or α-naphtholphthalein as indicator (A., 1939, I, 94) is given. L. S. T.

Lecture demonstrations of action of uni- and multi-component catalysts in heterogeneous systems. A. KRAUSE (Rocz. Chem., 1939, **19**, 477—479).—Indigo-carmine is rapidly decolorised by dil. H_2O_2 in presence of a CuO–FeO·OH catalyst. R. T.

Geochemistry

Measurements of chloride, nitrate, and nitrite present in the water of the monsoon rains at Bombay. R. NARAYANASWAMI (Proc. Indian Acad. Sci., 1939, **9**, A, 518—525).—Measurements during the 1938 season are recorded. H_2O collected at the times of thunder-showers contains more NO_3' and NO_2' than at other times, the excess of NO_2' being > that of NO_3'. Light rain, as opposed to heavy rain, increases the Cl' content on account of the larger no. of drops able to bring down the Cl'-containing nuclei in the atm. The data are compared with records from other parts of the world. C. R. H.

Western Pacific Ocean. IV. Refractive index of sea-water. Y. MIYAKE (Bull. Chem. Soc. Japan, 1939, **14**, 239—242).—$n_D^{25} = 1·33249_7 + 0·000334 \times$ % Cl'. This result agrees well with that calc. from the ionic refractivities for a solution of the same composition. T. H. G.

Volcanoes of Japan. IX. Determination of the proportion of heavy water in the spring water found in the neighbourhood of the Asama Volcano. Y. SHIBATA, K. NOGUCHI, and O. KANEKO (Bull. Chem. Soc. Japan, 1939, **14**, 274—279).—Assuming that in the beginning of geochemical time the lighter isotopes of the elements forming the mineral ingredients of the earth combined with greater ease than the heavier isotopes, deep-seated, juvenile H_2O supposedly of primeval origin, should contain less D and ^{18}O than the surface waters and so should have a smaller d. The d of the waters from springs in the neighbourhood of the Asama volcano have been measured against Tokyo city tap-H_2O as a standard surface H_2O, and found to be 1—2 × 10^{-6} less. T. H. G.

Volcanoes of Japan. XVIII. Density measurements on the waters obtained by condensing the vapours emitted from fumaroles. S. OANA (Bull. Chem. Soc. Japan, 1939, **14**, 279—283).—The H_2O condensed at fumaroles invariably has a d > that of surface H_2O although further observations on H_2O from other hot springs confirm the smaller d found in the neighbourhood of the Asama volcano. It is suggested that the H_2O from fumaroles consists largely of $H_2^{18}O$, for which two possible explanations are suggested : (i) an exchange reaction between ^{16}O from the H_2O and ^{18}O from the air catalysed by the surfaces of the rocks at the temp. of the fumarole, (ii) a separation of the isotopes by age-long distillation of the magmatic H_2O. T. H. G.

Geochemical investigation of the spreading of the Urov disease. A. P. VINOGRADOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 64—67).—An investigation of the drinking-H_2O in regions where the Urov disease (akin to rickets) is prevalent has been carried out. " Affected " waters (i.e., those in the region where the disease is prevalent) contain much less mineral matter, and particularly Ca, than " healthy " waters. A. J. M.

Ground waters of the Houston–Galveston [Texas] area. Chemical character and industrial utility. (MISS) M. D. FOSTER (Ind. Eng. Chem., 1939, **31**, 1028—1034).—The results of a survey of the water resources of the area undertaken during 1932—1937 and previously published are discussed. C. R. H.

Analysis of the Marijano spring at Gabernik. S. MIHOLIĆ (Bull. Soc. Chim. Yougoslav., 1938, **9**, 201—204).—Analytical data are recorded. R. T.

Occurrence of germanium in hot springs of Senami. K. KURODA (Bull. Chem. Soc. Japan, 1939, **14**, 303—304).—The Ge content, determined spectrographically, is ∼0·03 p.p.m. F. L. U.

Occurrence of beryllium in hot springs of Matunoyama. K. KURODA (Bull. Chem. Soc. Japan, 1939, **14**, 305—306).—The Be content, determined spectrographically, is 0·04—0·08 p.p.m. F. L. U.

Transport of dissolved salts by the Niger in 1938. M. G. ENIKEFF (Compt. rend., 1939, **209**, 229—231).—The transport of salts between Banankoro and Kirango, estimated from electrical resistance measurements at Banankoro, is max. in June and October. The wt. of salts removed annually is ∼70 kg. per sq. km. of river bed. A. J. E. W.

Analysis of hot-spring gases. S. H. WILSON (New Zealand J. Sci. Tech., 1939, **20**, 233—248B).—Methods of collection and analysis of gas samples are described and discussed in detail. H_2S is determined by absorption in 0·1N-I and titration with $Na_2S_2O_3$. CO_2 is absorbed in aq. KOH and the vol. decrease measured, the method allowing retention of the residual gas. SO_2, CS_2, and COS were not detected; their occurrence is unlikely except in presence of active vulcanism involving rapid cooling from a magma. SO_2 can be determined by titrating the H_2SO_4 after the I titration. COS can be absorbed in ammoniacal $CaCl_2$ and determined as $BaSO_4$ after oxidation, or dissolved in 5% KOH and titrated with I. A. J. E. W.

Showings of gas in the Lower Niman region. N. A. NATIS (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 68—70).—Issues of gas in the region of the Niman river consist mainly of N_2 and inert gases. The geology of the region is described and discussed with particular reference to the origin of the gases. A. J. M.

Helium content of rock-salt and sylvine. B. KARLIK (Mikrochem., 1939, **27**, 216—230).—A review.

New data on volcanic gases : the 1938 eruption of Nyamlagira. J. VERHOOGEN (Amer. J. Sci., 1939, **237**, 656—672).—Temp. measurements at various points in the lava stream and of the lava lake are recorded. The highest temp. observed is 1160°. The thermal effects of the burning gases are small, and the flames do not re-fuse the solid lava. Spectroscopic investigation of the flames showed the presence of Na, K, and N_2 and unidentified bands near 4400 A. The amount of gas discharged compared with the amount of lava is probably <1%, and the activities of gases and lava appear to be independent of each other. The potency of the gases as thermal and mechanical agents is negligible. The probability that magmas inside volcanoes are not saturated with gases is discussed. L. S. T.

Evolution of [natural] gas at Keuruu [Finland]. V. OKKO (Suomen Kem., 1939, **12**, A, 88—90).—Natural gas is evolved from >20 places in a shallow creek and contains CH_4 71, N_2 22·5, O_2 5·5, and CO_2 0·3%. It is formed from plant remains, laid down in shallow fresh H_2O in the Litorina period, which are rich in diatoms. M. H. M. A.

Recent discovery of an important hydrocarbon deposit in the Petites Pyrenees, to the north of Saint-Goudens. L. BERTRAND and L. BARRABÉ (Compt. rend., 1939, **209**, 399—401).—A geological description of the locality is given. Gas (CH_4 82, higher paraffins 17·5%) has been found at a depth of 1520 m., and the occurrence of petroleum is predicted. A. J. E. W.

Geological thermometry. E. JENSEN (Tids. Kjemi, 1939, **19**, 91—94).—A review of methods for the determination of temp. of rock formation. M. H. M. A.

Diabase or dolerite—a question of nomenclature. T. KROKSTRÖM (Geol. Fören. Stockholm Förh., 1936, **58**, 419—424; Chem. Zentr., 1937, i, 1910).—The use of the names " dolerite " for rocks of recent origin consisting chiefly of augite and plagioclase, and " diabase " for metamorphic rocks, is preferred. A. J. E. W.

Wiikite and its chemical composition. II. J. ANT-WUORINEN (Bull. Comm. géol. Finlande, 1936, **9**, 213—229; Chem. Zentr., 1937, i, 2344).—Wiikites are shown by mechanical treatment to contain other minerals, SiO_2 and S occurring only in impurities. β- and α-wiikites have the compositions $2Y_2O_3,1·5Nb_2O_5,1·5H_2O$ and $3CaO,UO_3,1·5Nb_2O_5,1·5H_2O$, respectively. These minerals are the end members of a series, in which extensive replacement of the bi- and ter-valent elements and Nb occurs. Nuolaite is not a wiikite. A. J. E. W.

Nephrite and asbestos from Paakila, Finland. E. RIMANN (Zentr. Min., 1936, A, 321—327; Chem. Zentr., 1937, i, 2344).—The anthophyllite–asbestos rocks contain veins of dense anthophyllitic nephrite. The primary anthophyllite belongs to the MgO-rich end-group of the series. The asbestos originates by metamorphosis from enstatitites and dunite rich in enstatite. A. J. E. W.

Dopplerite from Keuru, Central Finland. E. KIVINEN (Bull. Comm. géol. Finlande, 1936, **9**, 69—73; Chem. Zentr., 1937, i, 2344).—The dopplerite occurs in a narrow vein under the peat layers as a soft black, amorphous mass, which shrinks considerably and loses 86·16% of its wt. on drying at 105°. The residue contains 12·79% of ash (largely Al_2O_3), and org. matter (C 45·56, H 6·10, N 1·78, O 46·47%). A. J. E. W.

Garnet-bearing cordierite-andesite from Hoyazo, near Nijar (Almeria Province, Spain). C. BURRI, I. PARGA-PONDAL, and A. HEIM (Schweiz. min. petr. Mitt., 1936, **16**, 226—262; Chem. Zentr., 1937, i, 2343).—The mineral is of endomorphic origin, and consists of a garnet–biotite–sillimanite gneiss (20) with SiO_2 (5—15) in a monzonitic quartz magma (75—65%). A. J. E. W.

Calcareous shells replaced by beidellite. C. S. ROSS and L. W. STEPHENSON (Amer. Min., 1939, **24**, 393—397).—The replacement by a pure clay mineral of calcareous shells while enclosed among sand grains coated with Fe-rich material is described. The chemical analysis recorded for the mineral is that of the high-Al beidellite member of the montmorillonite

group. The mechanism of the replacement is discussed. L. S. T.

Salesite, a new mineral from Chuquicamata, Chile. C. PALACHE and O. W. JARRELL (Amer. Min., 1939, 24, 388—392).—*Salesite* (I), $CuIO_3(OH)$, orthorhombic, $a : b : c$ $0.4442 : 1 : 0.6241$, a_0 4.78, b_0 10.77, c_0 6.70 A., ρ 4.77±0.05, hardness 3, α 1.786± 0.005, β 2.070±0.01, γ 2.075±0.01, biaxial negative, has [F. A. GONYER] CuO 30.62, Na_2O 0.59, I_2O_5 64.79, H_2O 3.68, total 99.68%. Basic Cu iodate, prepared artificially, and (I) differ in cleavage and optical properties. L. S. T.

Colusite—its occurrence, paragenesis, and genetic significance. R. NELSON (Amer. Min., 1939, 24, 369—376).—The mode of occurrence of colusite (I) in the Butte, Montana, mines is described. (I) is a primary mineral, occurring with minerals deposited at relatively high temp. It contains Cu, Sn, As, and S with minor amounts of V, Sb, and Fe probably in solid solution. ρ is 4.4—4.6. Structure revealed by iridescent filming is described, and photo-micrographs are reproduced. Paragenesis is discussed. L. S. T.

Re-examination of colusite. H. BERMAN and F. A. GONYER (Amer. Min., 1939, 24, 377—381; cf. preceding abstract).—Colusite (I) is isometric, hexatetrahedral, with a_0 10.60±0.01 A., $ρ_{obs.}$ 4.50, $ρ_{calc.}$ 4.434, hardness 3—4, Cu 47.99, Fe 1.09, Sn 6.71, V 2.28, Te 1.26, Sb 0.19, As 9.54, S 30.65, total 99.71%. Other chemical analyses of (I) are discussed. (I) is a member of the tetrahedrite group, and the formula for half the cell contents is $Cu_{12}(As,Sn,V,Te,Fe)_4S_{16}$. L. S. T.

Correlation of quartz deformation with its crystal structure. H. W. FAIRBAIRN (Amer. Min., 1939, 24, 351—368).—A discussion of gliding and rupture in quartz as related to cryst. structure. L. S. T.

Occurrence of riebeckite in the Michipicoten district, Ontario. M. H. FROHBERG (Amer. Min., 1939, 24, 382—387; cf. A., 1938, 106).—Riebeckite (I) occurs as a hydrothermal alteration product accompanying lamprophyre dykes from which it was introduced locally into the Au-bearing and other quartz veins. (I) was not associated with the Au-bearing solutions. L. S. T.

Stereochemistry and classification of silicates. F. PENTA (Annali Chim. Appl., 1939, 29, 241—252).— A discussion of the structure of the natural silicates, based on the conclusions of Bragg, Niggli, Strunz, *et al.* F. O. H.

Granitisation and associated processes. M. MACGREGOR and G. WILSON (Geol. Mag., 1939, 76, 193—215).—It is concluded that granitisation involves metasomatism and/or mechanical penetration by magma. L. S. T.

Black oolites in the Dogger of N.E. Yorkshire. R. H. RASTALL and J. E. HEMINGWAY (Geol. Mag., 1939, 76, 225—233).—Black oolite, a new type of rock from various localities, is described. The oolites are hard, dull black rocks with closely packed ooliths and a lustrous cryst. cement of siderite. Phosphatic grains occur frequently both as nuclei of the ooliths

and as isolated grains, and quartz grains ≯10% of the rock are also distributed throughout the rock. On ignition, the ooliths turn white and their black colour is due probably to org. material. The analysis [W. H. HERDSMAN] of the separated black ooliths is SiO_2 74.85, Al_2O_3 5.15, FeO 0.82, CaO 0.46, MgO 0.22, Na_2O + K_2O 0.84, H_2O 14.15, org. matter 2.95, total 99.44%. The origin of the rock is discussed. L. S. T.

Neogenesis of minerals by heating in gases and water vapour under high pressures. Production of artificial metamorphic phenomena. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1939, 209, 175—177).—Minerals were heated for 10 days at ~600° with H_2O or aq. alkali under the pressure (3000—4000 kg. per sq. cm.) of the detonation products of an explosive, the mineral being protected from the explosion wave. Mica, spinels, and a highly refringent and birefringent mineral resembling epidote were produced at the grain boundaries in large crystals of a chloritoschist. A finely cryst. schist gave sericite, the calcite plates being partly converted into an unidentified mineral. Halloysite in a clay was replaced by sericite with loss of plasticity. The changes are more pronounced in presence of alkali. The experiments emphasise the importance of mineralogical changes under the action of gases. A. J. E. W.

Measurement of geological time by analysis of monazite. I. Determination of lead and thorium. E. KROUPA (Mikrochem., 1939, 27, 165—175).—Methods are given for the determination of Pb (as $PbSO_4$) and Th (as ThO_2) in 1 g. of monazite. Accurate determination of these elements is the best method of determining the approx. age of the mineral. J. W. S.

Torbanites of New South Wales. I. J. A. DULHUNTY (J. Proc. Roy. Soc. New South Wales, 1939, 72, 179—198).—For the various constituents of torbanite, distinguished microscopically, the names gelosite, retinosite, humosite, and matrosite are suggested. Some jet is also present, and secondary chalcedonic SiO_2 in part replaces the gelosite. The amounts of these, determined by micrometric measurements, are correlated with the physical properties of torbanites from several localities. These torbanites contain volatile hydrocarbons 14.60—82.17, fixed C 4.97—23.05, ash 3.52—80.43%; d 1.032—2.004. L. J. S.

Heavy minerals in coal measures of New South Wales. A. G. CULEY (J. Proc. Roy. Soc. New South Wales, 1939, 72, 75—105).—Records are given of the heavy minerals present in the sedimentary rocks of the Upper Coal Measures and the Upper Marine Series of the Kamilaroi System from several localities. L. J. S.

Volcanic tufas of the Carpathian foothills. M. KAMIENSKI (Arch. Min. Soc. Sci. Varsovie, 1936, 12, 16—57; Chem. Zentr., 1937, i, 1402).—A description and detailed study of the genesis of white to bright-green vitreous tufas containing plagioclase, quartz, and biotite, with Fe oxides, amphibole, and zircon as accessory, and chlorite, muscovite, and calcite as secondary, constituents. A. J. E. W.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

NOVEMBER, 1939.

Light excitation with homogeneous canal rays of low velocity. F. ENGELMANN (Z. Physik, 1939, **113**, 462—481).—A canal-ray apparatus is described which permits the excitation of light by impact between two particles to be examined over the range 1—10 kv. Collisions between H atoms and He give rise to the Balmer lines, He excitation also appearing above 2 kv. Collisions between H^+ and He give rise to strong He excitation, and in those between H and He, and D and He, the latter is the stronger. In the case of H–A and D–A collisions the degrees of excitation are approx. equal. L. G. G.

Determination of temperature of the negative glow from band spectra. L. VEGARD and K. G. DORUM (Avh. norsk. Vidensk.-Akad. Oslo, I, Mat.-nat. Kl., 1936, No. 1, 15 pp.; Chem. Zentr., 1937, i, 2737).—Intensity distribution measurements on the R-branches of the $^2\Sigma^+ \rightarrow {}^2\Sigma$ transition of N_2^+, at 3914 A., lead to temp. of 290—314° K. A. J. E. W.

Sodium D-lines in the night sky glow. G. CARIO and U. STILLE (Z. Physik, 1939, **113**, 442—448).—A general discussion on the origin of the Na in the atm., and the excitation process by which the D-lines are emitted. L. G. G.

X-Ray resonance absorption lines in the argon K spectrum. L. G. PARRATT (Physical Rev., 1939, [ii], **56**, 295—297).—Recorded with a two-crystal vac. spectrometer, the absorption curve for A gas near the K absorption edge is analysed in terms of the main edge and the $1S \rightarrow nP$ ($n > 3$) series of resonance absorption lines, both edge and series members being determined uniquely. N. M. B.

Broadening and displacement of the medium and higher potassium series lines through helium at high pressure. C. FÜCHTBAUER and W. VON HEESEN (Z. Physik, 1939, **113**, 323—333).—The displacements and broadening of the eight K lines $1s$—$5p$ to $1s$—$12p$ have been determined in relation to the density of the impacting He up to a pressure of 55 atm. Displacements are approx. $\propto$ relative density and are all towards the violet, but the broadening decreases from its max. at $1s$—$4p$ as the higher series members are reached. L. G. G.

Vacuum wave-length measurements in the iron spectrum by means of the reflexion echelon grating. W. E. WILLIAMS and A. MIDDLETON (Proc. Roy. Soc., 1939, A, **172**, 159—172).—The $\lambda\lambda$ of 47 lines have been determined directly against the red Cd standard; the accuracy of the method justifies the vals. being given to eight figures. G. D. P.

Third spark spectrum of krypton, Kr IV. A. B. RAO and S. G. KRISHNAMURTY (Proc. Physical Soc., 1939, **51**, 772—777).—The spectrum of a highly condensed discharge through fine capillary tubes containing Kr was studied with high dispersion. Multiplets $5s^4P$—$5p^4D$, $5s^4P$—$5p^4P$, etc. in the near ultra-violet are identified, term vals. are given, and data and classifications for $\sim$60 lines are tabulated. N. M. B.

Hyperfine structure of the iodine spectrum. T. SCHMIDT (Z. Physik, 1939, **113**, 439—441).—The hyperfine structure of the $5p^3(^2D)6p^3F_2$ and $5p^3(^2D)6s^3D_2$ terms of the I II spectrum is determined. Deviations from the quadratic law for the hyperfine structure levels, alleged by Tolansky, are not confirmed. L. G. G.

K absorption discontinuities of the elements lanthanum (57), cerium (58), praseodymium (59), neodymium (60), and samarium (62). (MME.) M. ROUAULT (Compt. rend., 1939, **209**, 434—436).—The $\lambda\lambda$ of the discontinuities (317·8, 305·8, 294·6, 283·9, 264·1 X.) have been redetermined by transmission measurements on layers of the oxalates [or $Ce_2(CO_3)_3$] of optimum thickness. v/R vals. for the electronic levels are tabulated, the highest level being $O_{II, III}$. A. J. E. W.

Isotope displacement in the Tl II spectrum. P. KÖHLER (Z. Physik, 1939, **113**, 306—322).—Hyperfine structure and isotope displacements of the Tl II spectrum show that all magnetic separations and isotope displacements fit into a uniform term scheme. The displacements of the $6sns\ ^1S_0$ series are in agreement with the $1/n_a^3$ law, but the abs. vals. calc. from Breit's theory are approx. twice too great. The displacements of the centres of gravity in all terms are as theory demands. L. G. G.

Interaction of configurations : sd—p^2. R. F. BACHER (Physical Rev., 1939, [ii], **56**, 385; cf. A., 1933, 331).—A correction. N. M. B.

Balmer emission of the planetary nebulæ. S. MIYAMOTO (Mem. Coll. Sci. Kyoto, 1938, A, **21**, 173—202).—The emission mechanism of Balmer lines is treated generally, considering both recombination and collision. The results are applied to model nebulæ and a method of estimating the electron temp. from the observed decrement of Balmer emission is described. The excitation of the normal H atom by slow electron impact is treated wave-mechanically. F. J. L.

Hydrogen emission near the limit of the Balmer series in the solar chromosphere. S. MIYAMOTO (Mem. Coll. Sci. Kyoto, 1939, A, **22**, 1—

11).—The H atoms of high energy in the solar chromosphere are influenced by other atoms and electrons, and distributed according to Boltzmann's law, as for free electrons, so that the capture theory can be used to derive the population for states of small quantum no. only. The ratio of the frequencies of collisional ionisation and of spontaneous transition varies with height in the chromosphere. Detailed measurements are obtained at a height of 1000 km.
F. J. L.

Relative intensities of the Stark effect components of the helium lines. L. MINNHAGEN (Z. Physik, 1939, **113**, 292—301).—The intensity ratios of the components of the ortho-He lines $2p$—$4q$ are obtained from the canal-ray method (canal-ray, field, and direction of observation mutually rectangular). Results do not agree quantitatively with Foster's theory.
L. G. G.

Luminous efficiency of ionised cæsium vapour. F. L. MOHLER (J. Opt. Soc. Amer., 1939, **29**, 152—157).—Theoretical. Computation of radiation and electrical characteristics for pressure and power input > those at present attainable give an optimum luminous efficiency of ~180 lumens per w. at 6000° K., when brightness and colour temp. are ~5400° and 3700° K. At 760 mm. Hg, brightness and colour are those of a black body.
L. J. J.

Semi-conductor theory of barrier-layer and point contact rectifiers. W. SCHOTTKY (Z. Physik, 1939, **113**, 367—414).—A theoretical survey of rectification at metal/semi-conductor interfaces, based on a comparison with electronic conditions in a vac. tube containing dissimilar metallic electrodes.
L. G. G.

Selenium photo-cells. III. Behaviour in a high-frequency circuit. F. GOOS (Z. Physik, 1939, **113**, 334—349; cf. A., 1939, I, 58).—A Se photo-cell is joined in parallel with a high-frequency oscillating circuit such that variations in frequency caused by illumination of the cell are compensated with a variable condenser. Because of the capacity associated with the barrier-layer, the resultant δC–time curves measure phenomena occurring in the Se layer only. Thus the normal yellow-green current max. disappears and is replaced by a max. in the long-λ (red) region. The behaviour of the Se resembles that of ZnS phosphors; it is explained in terms of resistance and capacity changes, and ϵ of the semi-conductor can be directly calc. The effects of temp. and light intensity on the cell are also observed.
L. G. G.

Influence of the cathode on the sparking potential of heavy hydrogen. F. L. JONES (Phil. Mag., 1939, [vii], **28**, 328—337).—A detailed account and extension of work reported elsewhere (A., 1939, I, 439). It is further shown that the second Townsend coeff. δ/α is the same for H_2 and D_2 (assuming α to be the same for both) when Z/ρ ($Z = $ v. per cm. and $\rho = $ gas pressure in mm. Hg) ≈ 100, but when $Z/\rho > 250$ δ/α is 20—100% greater for H_2 than for D_2. It is concluded, therefore, that if $Z/\rho = 150$ the chief cathode process is photo-electric emission, but if >250 the secondary emission is due to the action of positive ions, the velocity of which is important in

connexion with the mechanism of secondary emission from the cathode (Al, Ni, Cu, Staybrite). T. H. G.

Process of electron liberation from incandescent solid bodies, from electron-optical investigations. A. GEHRTS (Z. tech. Physik, 1936, **17**, 656—660; Chem. Zentr., 1937, i, 2542).—Experiments with thoriated cathodes confirm Lenard's theory, electrons being liberated immediately before emission from atoms caused to interact by thermal motion.
A. J. E. W.

Influence of oxygen on thermionic emission, from investigations with the electron microscope. H. MAHL (Z. tech. Physik, 1936, **17**, 653—656; Chem. Zentr., 1937, i, 2542).—O is attached most easily to thoriated W and Mo at the Th-covered crystallites which have the highest emissive power in high vac. O changes the intensity distribution in the emission pattern. Evaporation of the O commences at the boundaries with O-free areas, and when complete leaves the Th layer almost unchanged. A. J. E. W.

New method of determining e/m for medium high velocities. J. AHARONI (Nature, 1939, **144**, 203—204).—The method described is particularly applicable to electrons or positrons forming the continuous spectrum from radioactive bodies.
L. S. T.

Transformation of impulse voltages. Observations of the scattering of electrons with the cloud chamber. E. HEUSE (Z. Physik, 1939, **113**, 514—525).—Owing to the limiting amplification factor attained (max. 1·6) the transforming up of voltage impulses is an impracticable means of obtaining high voltages for the production of fast electrons. Measurements of the energies of the latter were made with a cloud chamber and lead to a discussion of the nature of electron scattering therein. L. G. G.

Mobility of alkali ions in gases. I. Attachment of water molecules to alkali ions in gases. R. J. MUNSON and A. M. TYNDALL. **II. Attachment of inert gas atoms to alkali ions.** R. J. MUNSON and K. HOSELITZ. **III. Mobility of alkali ions in water vapour.** R. J. MUNSON (Proc. Roy. Soc., 1939, A, **172**, 28—42, 43—50, 51—54).—I. An experimental arrangement for studying the formation of clusters by the attachment of H_2O mols. to alkali ions is described. In A, Kr, and Xe a cluster contains $\not> 6$ mols. H_2O. The results indicate that attachment takes place in a three-body collision between an ion, a gas mol., and a H_2O mol., and that further growth of the cluster is rapid. Vals. of the mobility of all the alkali ions in all the inert gases are tabulated.

II. Evidence has been obtained for the attachment of inert gas atoms to Li ions. In He at 30° K. an appreciable fraction of the ions is of the form Li^+, nHe; the fraction is smaller at 90° K. and zero at room temp. The val. of n is <2. Similar results are obtained for Ne and A. In Xe and Kr every ion collects one or two gas atoms at room temp. K collects no gas atoms in A at 195° K., owing to the larger size of K^+. The energy of dissociation of Li^+ and the gas atom is estimated.

III. At low vals. of the ratio field/pressure (E/p)

the mobility of alkali ions in H_2O vapour decreases with increasing mass of ion; the mobilities are all low, suggesting that the ions exist as clusters. At higher vals. of E/p the clusters begin to break up, and the mobilities increase. The results are compared with the behaviour of ions in liquids.   G. D. P.

Nuclear spin and magnetic moment of $^{27}_{13}Al$. S. MILLMAN and P. KUSCH (Physical Rev., 1939, [ii], **56**, 303—304; cf. A., 1939, I, 297).—The mol. beam magnetic resonance method gives an observed gyromagnetic ratio $1.451 \pm 0.004 e/2mc$, and a comparison with the val. obtained from the hyperfine splitting of several Al lines for various assumed vals. of the spin gives a nuclear spin 5/2. This leads to a magnetic moment (experimentally positive) of 3.628 ± 0.010 nuclear magnetons.   N. M. B.

Theory of magnetic effects in the plasma of an arc. L. TONKS (Physical Rev., 1939, [ii], **56**, 360—373; cf. A., 1938, I, 4).—The equations governing electron drift in the presence of a magnetic field are applied to the low-pressure uniform positive column plasma with reference to the effect of transverse and longitudinal fields, diamagnetic susceptibility of the column, and the constrictive effect of the arc's own magnetic field.   N. M. B.

Protium–deuterium ratio and at. wt. of hydrogen. J. A. SWARTOUT and M. DOLE (J. Amer. Chem. Soc., 1939, **61**, 2025—2029).—Utilising the gaseous exchange reaction $H_2 + HOD \rightleftharpoons HD + HOH$, D-free H_2O containing the normal isotopic ratio of O has been prepared from Lake Michigan and Atlantic Ocean H_2O, and determinations of ρ, the ratio of H : D, were respectively 6970 and 6900, yielding 1.0080 instead of 1.0081 for the chemical at. wt. of H. H_2O prepared from D_2-free H_2 and atm. O_2 was 6.6 p.p.m. heavier than H_2O containing Lake Michigan O and pure H. Therefore the at. wt. of O in air is > that of the Lake Michigan O by 0.000119 ± 0.000002 at. wt. unit.   W. R. A.

^{3}He in helium. L. W. ALVAREZ and R. CORNOG (Physical Rev., 1939, [ii], **56**, 379).—The use of the 60-in. cyclotron as a mass spectrograph has shown that ^{3}He is a stable isotopic constituent of He ($^3He^{++}$ has a range of 54 cm. in air).   N. M. B.

Luminescence of mercury vapour along an α-ray pencil, and transfer of nitrogen excitation to mercury. A. LUYCKX (Proc. Roy. Soc., 1939, A, **172**, 492—501).—The luminescence excited by α-rays from a Rn source in a tube containing N_2 and Hg vapour in the presence of Fe_3O_4 was studied spectrographically. No luminescence is observed in the absence of N_2; it is extinguished by traces of air but H_2 has no quenching effect. It is concluded that the N_2 mols. excited by the α-rays transfer their energy to diat. mols. responsible for the emission of the 4850 A. continuum.   G. D. P.

γ-Rays of ionium. A. G. WARD (Proc. Camb. Phil. Soc., 1939, **35**, 322—326).—The absorption of the harder γ-rays from ionium has been studied: the first, of energy 68 ± 1 ke.v., by the method of bracketing, making use of the K absorption discontinuities of Ta and W; the second, of energy 190 ± 20 ke.v., by analysis of the absorption curves. The intensity of these γ-rays is estimated to be 1 quantum in 10^{-3} disintegration for each γ-ray.   F. J. L.

Determination of the half-value periods of radium-C' and thorium-C', with a note on time lags in a Geiger counter. J. V. DUNWORTH (Nature, 1939, **144**, 152—153).—A coincidence counter with an electrical resolving time $\approx 10^{-7}$ sec. gives $1.50(\pm 0.20) \times 10^{-4}$ and $3(\pm 1) \times 10^{-7}$ sec. for the periods of Ra-C' and Th-C', respectively.   L. S. T.

Non-existence of electrons of multiple mass in the β emission of radium-E. M. HAÏSSINSKY, S. ROSENBLUM, and R. J. WALEN (J. Phys. Radium, 1939, [vii], **10**, 355—360).—Investigation of the β spectrum of Ra-E, using an apparatus which is described, shows the absence of heavy electrons, contrary to the hypothesis of Jauncey (A., 1938, I, 169).   W. R. A.

Calorimetric study of the radiation from the active deposit of thorium. L. WINAND (J. Phys. Radium, 1939, [vii], **10**, 361—365; cf. A., 1938, I, 6).—A new precision adiabatic calorimeter which employs a non-uniform temp. method has been constructed. Simultaneous application of this method and the classical uniform temp. method to the energy liberated by the active deposit of Th gives 1 mg. γ equiv. = 1.09 millicurie.   W. R. A.

Non-additivity in scattering cross-sections of slow neutrons. M. KIMURA (Proc. Imp. Acad. Tokyo, 1939, **15**, 214—216).—HgS shows a large back-scattering for thermal neutrons in spite of the strong absorption in Hg. The scattering cross-sections of Hg, S, and HgS for slow neutrons were determined, and it was found that the additive law fails completely in this case. With " D " neutrons, however, the additive law holds within the limits of experimental error.   A. J. M.

Scattering by uranium nuclei of fast neutrons and the possible neutron emission resulting from fission. L. GOLDSTEIN, A. ROGOZINSKI, and R. J. WALEN (Nature, 1939, **144**, 201—202).—Experiments with neutrons of Po + Be show that the sum of the cross-sections of elastic and inelastic scattering and of fission for the U nucleus is $11.2 \pm 1.5 \times 10^{-24}$ sq. cm. This val. implies a mean path in U $\ll$ that usually admitted, and suggests that smaller masses than those hitherto expected might be used to show chain fission.   L. S. T.

Possible delay in the emission of neutrons from uranium. D. F. GIBBS and G. P. THOMSON (Nature, 1939, **144**, 202).—Experiments with an intermittent neutron source show that the majority of neutrons produced in the fission of U appear with a delay $\ngtr 10^{-3}$ sec.   L. S. T.

Energy of high-velocity neutrons by the photographic method. C. F. POWELL and G. E. F. FERTEL (Nature, 1939, **144**, 115—116).—A method for determining the energy of protons and neutrons by measurements of tracks made by these particles on photographic plates is outlined. Curves for B + D protons show that the resolving power obtainable equals that of the counter method. Curves reproduced for B + D and Be + D neutrons

show that the photographic method has a higher resolving power than the expansion chamber technique, over which it has other important advantages.　　　L. S. T.

Elastic collisions of protons and very fast neutrons. M. NOGAMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1939, **36**, 244—250).—Mathematical. The calc. cross-sections for neutrons of 15 to 35 Me.v. energy range from 0·65 to 0·25 × 10^{-24} sq. cm.　　　F. J. G.

Induced radioactivity in cadmium and indium. J. M. CORK and J. L. LAWSON (Physical Rev., 1939, [ii], **56**, 291—294; cf. A., 1937, I, 277).—In Cd bombarded with deuterons two chain reactions are observed : Cd (56 hr.) → In (4·5 hr.) and Cd (3·75 hr.) → In (2·1 hr.). There is evidence that a new 65-hr. γ-radiation is due to an excited state of normally stable ^{113}In. Accurately measured data on Cd and In radiations are tabulated.　　　N. M. B.

Electron and positron spectrum of radioactive arsenic. W. SCHAEFFER and P. HARTECK (Z. Physik, 1939, **113**, 287—291; cf. A., 1938, I, 339).—An extension of the earlier work.　　　L. G. G.

Fission of protactinium. A. VON GROSSE, E. T. BOOTH, and J. R. DUNNING (Physical Rev., 1939, [ii], **56**, 382).—$^{231}_{91}$Pa bombarded with fast neutrons from the cyclotron undergoes fission, the no. of fissions being 30—40 times the no. observed from the same amount of Th. The threshold is ~1 Me.v. No fissions were produced by thermal neutrons or photoneutrons. Chemical separation showed that two of the products were Rb (18 min.) and Cs (30 min.). Results are compared with those for the fission of $_{90}$Th and $_{92}$U.　　　N. M. B.

Coincidences between β- and γ-rays in indium. L. M. LANGER, A. C. G. MITCHELL, and P. W. McDANIEL (Physical Rev., 1939, [ii], **56**, 380—381). —In an attempt to determine whether the β-ray spectrum of ^{116}In (54 min.) is simple or complex, γ-γ and β-γ coincidences produced in two fast Geiger–Müller counters were recorded. The γ-γ coincidences yielded a val. of 0·65±0·06 per 1000 γ-rays recorded. When the no. of β-γ coincidences per β-particle is plotted against thickness of β-absorber, the val. of the ordinate remains const., giving no indication of a complex spectrum. A study of the absorption of the total radiation in Al shows evidence of discontinuities at 0·8 Me.v. and at the 1·2 Me.v. end point (cf. Brown and Mitchell, A., 1936, 1441). The ^{116}In (54 min.) →^{116} Sn disintegration appears to be a simple β-transition followed, on the average, by two γ-rays.　　　N. M. B.

Excitation of γ-radiation in the processes of proton capture. S. C. CURRAN and J. E. STROTHERS (Proc. Roy. Soc., 1939, **A**, **172**, 72—89).—Excitation curves relating the intensity of emitted γ-radiation to the energy of the incident proton were determined for the elements D, Li, Na, Mg, P, and Cl with proton energies up to 1 Me.v. A no. of new resonance peaks were observed.　　　G. D. P.

Resonance phenomena in scattering of α-particles by some light nuclei. S. DEVONS (Proc. Roy. Soc., 1939, **A**, **172**, 127—142).—The scattering of α-particles by the elements C, N, O, F, Ne, and A was studied, resonance peaks being observed for C, N, O, and F.　　　G. D. P.

Scattering of α-particles in helium. S. DEVONS (Proc. Roy. Soc., 1939, **A**, **172**, 559—567).—The scattering was measured at angles of 27° and 38·5° for energies up to 8·5 Me.v. The results are consistent with the existence of a broad level of ^{8}Be with spin two quantum units, and with energy ~3·3 Me.v. in excess of the ground state.　　　G. D. P.

Scale for predicting nuclear transformations. V. KARAPETOFF (J. Chem. Educ., 1939, **16**, 283—285).—The construction and use of a nine-point scale, which, when placed on a chart of isotopes, permits prediction of nuclear transformations and disintegrations of the elements on bombardment with protons, deuterons, neutrons, or α-particles, is described.　　　L. S. T.

Evaluation of the beta upper energy limits [of radio-elements] with simple absorption data. J. B. R. RAJAM, P. C. CAPRON, and M. DE HEMPTINNE (Nature, 1939, **144**, 202—203).—The method proposed utilises absorption data to construct the Fermi and Konopinski–Uhlenbeck theoretical curves and deduces the upper limit by extrapolation. Advantages of the method are discussed, and its application to radio-Rh and -Ag, obtained by slow neutron activation, is described.　　　L. S. T.

Nuclear reactions in the continuous energy region. N. BOHR. R. PEIERLS. G. PLACZEK (Nature, 1939, **144**, 200—201).—A theoretical discussion.　　　L. S. T.

Production of yukons. G. COCCONI (Nuovo Cim., 1939, **16**, 78—85).—The energy spectrum of the electrons constituting the primary cosmic radiation is calc., in good agreement with the experimental results at high altitudes. Assuming that the most penetrating portion of the radiation consists of yukons, the probability of their production from primary electrons is calc.　　　O. J. W.

Nuclear energy levels in ^{10}B. P. G. KRUGER, F. W. STALLMANN, and W. E. SHOUPP (Physical Rev., 1939, [ii], **56**, 297—302; cf. A., 1938, I, 6).—Data obtained by the Compton recoil electron method and the ± electron pair production method indicate 31 lines in the γ-ray spectrum of ^{10}B. These are accounted for by 9 energy levels which show approx. agreement with the neutron spectrum from the same reaction (cf. Staub, A., 1939, I, 171). A provisional classification based on a correlation of observed and predicted energy levels is given.　　　N. M. B.

Disintegration of the separated isotopes of boron under proton and deuteron bombardment. C. L. SMITH and (MISS) E. B. M. MURRELL (Proc. Camb. Phil. Soc., 1939, **35**, 298—303).—The disintegration of the separated isotopes of B under proton and deuteron bombardment has been investigated, and previous results are confirmed. A new excitation level of ^{8}B is given as 7·5 Me.v. above the ground state.　　　F. J. L.

Production of ^{8}Li by bombardment of boron with neutrons. (MISS) A. M. LAWRANCE (Proc. Camb. Phil. Soc., 1939, **35**, 304—308).—The decay

period of the α-activity product produced on bombarding B with neutrons from Li + D is the same as that of ^{8}Li. Neutrons from a Be + D source (max. energy 4·5 Me.v.) produce no activity. A max. in the no.–range distribution of α-particles emitted by ^{8}Li occurs at a range of about 6 mm. F. J. L.

Cross-section for the reaction $^2H + ^2H \to ^1H + ^3H$ with a gas target. J. A. VAN ALLEN, A. ELLETT, and D. S. BAYLEY (Physical Rev., 1939, [ii], 56, 383).—The abs. cross-sections $\times 10^{26}$, with a target of D_2 at 0·1 mm. pressure, for bombarding energies of 50, 100, 200, 330, and 390 ke.v. are 1·4, 1·6, 2·5, 3·8, and 4·9 sq. cm., respectively. The error is 6—8% excluding that due to contamination of the beam with ^1H and to recombination of the ions in the beam in passage through the target. N. M. B.

Very weak [cosmic] radiation. G. BERNARDINI and B. FERRETTI (Nuovo Cim., 1939, 16, 173—180).—Measurements are recorded of the penetrating power through Pb and other materials of the weak radiation consisting of electrons and γ-rays and having a mean energy <10 Me.v. The theory of this radiation is discussed. O. J. W.

Showers produced by penetrating rays. W. F. G. SWANN and W. E. RAMSEY (Physical Rev., 1939, [ii], 56, 378).—An arrangement of Pb slabs and Geiger counters is described, and data are tabulated for the no. of events which are accompanied by 1—8 additional rays. Results are considered in relation to mesotron energies. N. M. B.

Shower production by penetrating cosmic rays. A. C. B. LOVELL (Proc. Roy. Soc., 1939, A, 172, 568—582).—The showers produced under thicknesses of Pb >10 cm. have been investigated. Analysis of the results shows that the observed showers can be accounted for as cascade showers produced by an electron which has been knocked-on in a direct collision with a mesotron. G. D. P.

Absorption of penetrating cosmic-ray particles in gold. J. G. WILSON (Proc. Roy. Soc., 1939, A, 172, 517—529).—Measurements were made with a cloud chamber of the curvature changes of tracks in a field of 10,000 gauss, using an absorber of Au 2 cm. thick. At low energies absorption is due entirely to ionisation; an estimate of the mass of the mesotron is obtained from a track of very low energy. At high energies a few particles were observed to undergo greater absorption. G. D. P.

Observations on cosmic rays using a large randomly operated cloud chamber. E. J. WILLIAMS (Proc. Roy. Soc., 1939, A, 172, 194—212).—A Wilson cloud chamber 30 cm. deep and 30 cm. diameter is described; it is used to investigate the energy spectrum of cosmic-ray particles below 300 Me.v. energy. Electron showers and tracks due to mesotrons were observed. G. D. P.

Directional distribution of the hard and soft components of cosmic radiation. J. BARNÓTHY and M. FORRÓ (Nature, 1939, 144, 116—117).—Measurements of the directional distribution of the hard and soft components of cosmic radiation can be explained by assuming that the vertical radiation

at sea-level consists of 65% mesons, 30% electrons produced in meson decay, and 5% electrons and heavy ionising particles produced by neutrinos. L. S. T.

New model of the point charge electron and of other elementary particles. E. C. G. STUECKELBERG (Nature, 1939, 144, 118). L. S. T.

Representation of the Lorentz group and Dirac's theory of the electron. G. GENTILE (Nuovo Cim., 1939, 16, 181—190).—Mathematical. O. J. W.

Deviation from the Coulomb law for a proton. W. E. LAMB, jun. (Physical Rev., 1939, [ii], 56, 384).—Mathematical. On the basis of current mesotron theories no short-range repulsion between a proton and an electron is possible. This result is in opposition to that of Fröhlich et al. (A., 1939, I, 447). N. M. B.

Vector model of the atom and theory of rotations. E. BONAUGURI (Nuovo Cim., 1939, 16, 202—224).—Mathematical. O. J. W.

Use of the thermodynamic conception for the normal state of the atomic nucleus. S. WATANABE (Z. Physik, 1939, 113, 482—513).—Mathematical. L. G. G.

Stability of nuclei against β-emission. K. FUCHS (Proc. Camb. Phil. Soc., 1939, 35, 242—255).—Theoretical. The general scheme of stable nuclei and the isotopic breadth of nuclei with odd charge no. are explained. The breadth of the isobaric region is calc., and its increase in passing from light to heavy atoms explained. F. J. L.

Virtual state of ^{5}He and meson forces. S. M. DANCOFF (Physical Rev., 1939, [ii], 56, 384—385).—Mathematical. N. M. B.

Classical theory of mesons. H. J. BHABHA (Proc. Roy. Soc., 1939, A, 172, 384—409).—The fundamental equations of motion of a neutron in a meson field are deduced. The energy of the field associated with a neutron and the scattering of mesons by neutrons are considered. It appears that the effective mass of the neutron (or proton) in nuclear phenomena is < the real mass by ~ 10 Me.v. The results obtained are compared with those derived from the quantised theory of mesons. G. D. P.

Protidons. E. SEVIN (Compt. rend., 1939, 209, 432—434).—Theoretical. The masses of "protidons," derived from protons by the action of primary photons in cosmic radiation, are considered; the most probable val. is $205·5m$. A. J. E. W.

Recent experimental results in nuclear isomerism. B. PONTECORVO (Nature, 1939, 144, 212—213).—A review. L. S. T.

Periodicity patterns of the elements. K. G. IRWIN (J. Chem. Educ., 1939, 16, 335—340).—The elements are arranged on an uncoiling spiral, each coil of which ends with a member of the inert gas group. Periodicity patterns are then traced on such spirals representing valency, metallurgical relationships, m.p., activity of the metals towards acids, density, behaviour of oxides, and metallic ion group analysis. L. S. T.

Improved periodic table. W. F. Luder (J. Chem. Educ., 1939, **16**, 393—395).—Ebel's arrangement of the elements (A., 1939, I, 169) is elaborated.   L. S. T.

Calculated wave functions and energy values for X-ray terms of potassium. W. A. Thatcher (Proc. Roy. Soc., 1939, A, **172**, 242—263).—Self-consistent field calculations, without exchange, are made for two states of the K atom. X-Ray ionisation energies are then calc.; good agreement with experimental vals. is obtained.   G. D. P.

Generalised formula for the Doppler effect. L. Fleischmann (J. Opt. Soc. Amer., 1939, **29**, 302—304).—A formula is developed to include velocities of source and observer which may be any function of time on any kind of path in space.   O. D. S.

Avogadro number. J. E. Johnston (J. Chem. Educ., 1939, **16**, 333—334).—A demonstration experiment for the determination of N from the electrolysis of dil. H_2SO_4 is described.   L. S. T.

Comparison of the velocity of visual and infra-red light by an astronomical method. J. S. Hall (J. Franklin Inst., 1939, **228**, 411—423).—The velocity of light has the same val. for 5500 A. as for 8660 A. within 16 m. per sec.   A. E. M.

Ultra-violet absorption of calciferol. S. K. Crews and E. L. Smith (Analyst, 1939, **64**, 568—570).—Calciferol is so photolabile that special precautions are necessary for the accurate determination of its absorption spectrum. By the continuous flow method, using the Spekker photometer, vals. of $E_{1\,cm.}^{1\%}$ 265 mμ. between 485 and 500 were obtained, whilst the normal technique gave lower vals. owing to decomp.   E. C. S.

Electronic transition of the Rydberg series type in the absorption spectra of hydrocarbons. (Miss) E. P. Carr and (Miss) H. Stücklen (J. Chem. Physics, 1939, **7**, 631).—17 olefinic hydrocarbons (A., 1938, 1, 173) examined show a group of narrow diffuse absorption bands of high intensity between 43,000 and 53,000 cm.$^{-1}$ The position of the first band in each compound is determined by the no. of alkyl groups bound to the doubly-linked C but is independent of the nature of the group. The plot of the position of the first band against the no. of the substituent alkyls is an approx. straight line passing through the val. 57,320 cm.$^{-1}$ for C_2H_4 measured by Price (A., 1935, 562). By analogy with C_2H_4 these first bands constitute the first electronic band system of a Rydberg series superimposed on a continuous band of high intensity which has, for most olefines, a max. at ~57,000 cm.$^{-1}$ The parallelism in position between the first bands in the Schumann region of all hydrocarbons containing C·CH:CH·C, and the similarity between the bands of *cyclo*hexene and *cis*-Δ^β-butylene is easily understood if the electronic transition is of the Rydberg series type where the electron concerned is non-bonding and the energy of the transition would be dependent primarily on the effective nuclear charge of the C atom.   W. R. A.

Absorption spectrum of further purified cyto-chrome c.—See A., 1939, III, 939.

Ultra-violet absorption spectra of bile-pigment iron compounds and bile pigments.—See A., 1939, III, 914.

Phototropy of anils and of solutions of the leuco-cyanides of malachite- and brilliant-greens.—See A., 1939, II, 506.

Laboratory analysis of the selective absorption of light by sea-water. G. L. Clarke and H. R. James (J. Opt. Soc. Amer., 1939, **29**, 43—55).—The absorption of light (3650—8000 A.) by natural and artificial sea-H_2O is compared with that of distilled H_2O, and the influence on absorption of dissolved salts and of suspended matter discussed.   F. J. L.

Rotation analysis of the $a'^3\Sigma^+ \rightarrow a^3\Pi$ CO bands. L. Gerö and K. Lörinczi (Z. Physik, 1939, **113**, 449—461).—The analysis of the 8–0, 9–0, 10–1, and 11–1 bands of the above system has been made. The rotation consts. are in good agreement with those obtained from perturbation data, and extrapolation towards lower vibration levels gives $B_e = 1·331$ cm.$^{-1}$ and $\alpha = 0·016$ cm.$^{-1}$ L. G. G.

Sulphur bands and an attempt to obtain HS bands. G. Glockler and W. Horwitz (J. Chem. Physics, 1939, **7**, 857).—Attempts to obtain the band spectrum of HS have failed although various S-containing gases and mixtures have been tried. The spectrum of S bands was always found. This indicates great instability of HS.   W. R. A.

Interpretation of the visible absorption of bromine. N. S. Bayliss and A. L. G. Rees (J. Chem. Physics, 1939, **7**, 854—855).—Mulliken's alternative interpretations (A., 1936, 1310) of the A and B components have been considered in the light of data on the visible Br continuum in solution and of other spectroscopic data.   W. R. A.

Nitric oxide in the earth's upper atmosphere. J. Kaplan (Nature, 1939, **144**, 152).—The spectrum of an afterglow produced by passing a very weak discharge through N_2 (at 10 mm.) containing a trace of O_2 shows certain NO bands strongly developed, but the β-system of NO, normally the stronger, is absent. In all other respects, this spectrum represents the best laboratory reproduction so far obtained of the light of the night sky. The NO bands are absent in the auroral afterglow obtained with a strong discharge. It is concluded that the NO bands are present in the light of the night sky, but cannot be observed owing to O_3 absorption. Much of the night-sky radiation appears to originate as low in the atm. as 25 km. Cosmic radiation may also be a major contributor to this light.   L. S. T.

Absorption spectrum of aluminium fluoride (AlF). G. D. Rochester (Physical Rev., 1939, [ii], **56**, 305—307).—A new band system in the region 2200—2350 A. is described. Of ~60 bands, 40 are placed in one system; five regions of absorption form five sequences, and an expression for the band heads is given. Vibrational consts. and classification data are tabulated.   N. M. B.

Influence of temperature and pressure on the infra-red absorption spectrum of gaseous and liquid hydrogen chloride up to the critical state.

W. WEST (J. Chem. Physics, 1939, **7**, 795—801).— The absorption spectra near 1·7 μ. of liquid HCl from −100° to the crit. temp. (52°) and of gaseous HCl from 1 atm. to the crit. pressure (82 atm.) have been investigated by a grating instrument using a pressure cell which is described. With HCl gas the fine structure disappears with increasing pressure until finally a simple rotation–vibration doublet is obtained. In the liquid state a single max. occurs at a rather lower ν than for the gas; ν increases with rise of temp. The shift with temp. is only partly explained by the hypothesis that a perturbation arises from the electrostatic action of neighbouring mols.; the shift observed is < that produced by inert solvents of the same dielectric const. as liquid HCl. W. R. A.

Infra-red absorption of hydrogen fluoride. A. M. BUSWELL, R. L. MAYCOCK, and W. H. RODE-BUSH (J. Chem. Physics, 1939, **7**, 856—857).—Examination of HF vapour by both a prism and a grating spectrometer confirms the data of Imes (A., 1921, ii, 4) and reveals very strong absorption at higher pressures which is attributed to association. The two main max. are at 2·95 and 2·87 μ. and have equal intensities. In CCl_4 there is no evidence of association and the spectrum shows probably three absorption max. instead of two; the middle one has greatly magnified intensity. W. R. A.

Vibration spectra and molecular structure. VII. Infra-red studies on the vapours of some carboxylic acids. R. C. HERMAN and R. HOF-STADTER (J. Chem. Physics, 1939, **7**, 630).—An erratum is noted (cf. A., 1939, I, 450) and an addendum dealing with the probable error in the heat of association of $EtCO_2D$ is given. W. R. A.

Vibration spectra and molecular structure. VIII. Absorption spectra of light and heavy phenol and aniline vapours. V. WILLIAMS, R. HOFSTADTER, and R. C. HERMAN (J. Chem. Physics, 1939, **7**, 802—805).—The spectra from 1 to 13 μ. of PhOH, PhOD, NH_2Ph, and ND_2Ph vapours have been measured with a rock-salt prism spectrometer. Comparison of the spectra of the isotopic analogues is made and the shifts of certain bands are discussed. Comparison is also made with available data for other physical states of PhOH and NH_2Ph. W. R. A.

N–H harmonic bands of pyrrole at 9900 A., and the structure of the pyrrole molecule. L. R. ZUMWALT and R. M. BADGER (J. Chem. Physics, 1939, **7**, 629—630).—The N–H absorption of pyrrole vapour has been photographed at 150° and 250° using high and low dispersion in order to re-examine the conclusions of Freymann (A., 1939, I, 179) that three bands at 9818 (strong), 9890 (weak), and 9961 A. (very faint) arose from different mol. species. At low dispersion the weak bands increase in intensity with rise of temp. relative to the 9818 A. band, indicating that the 9818 A. band is due to absorption from the ground level whilst the other two involve absorption from two different excited states. High-dispersion studies show that these excited states correspond with different vibrational excitation and not with different geometrical configurations of the mol. The 9961 A. band could not be photographed under high disper-

sion; the two others show identical envelopes differing only in intensity, and consisting of P and R branches and a narrow Q branch. From consideration of band spacings and intensities it is concluded that (i) the three bands form a sequence, (ii) the 9890 A. band is ascribable to a transition in which some low-frequency vibration is excited in both upper and lower levels, (iii) there is an unusually large interaction between the N–H valency vibration and some low-frequency vibration (~650 cm.⁻¹), (iv) the interaction in (iii) may involve some bending motion of the N–H linking with respect to the rest of the mol. W. R. A.

Infra-red and Raman spectra of polyatomic molecules. IX. Dimethylacetylene, C_4H_6. B. L. CRAWFORD, jun. (J. Chem. Physics, 1939, **7**, 555—562; cf. A., 1939, I, 354).—The infra-red absorption of gaseous C_4H_6 (2—24 μ.) and the Raman spectrum of the liquid have been studied. Experimental data have been analysed and the fundamental νν of the mol. determined. The νν agree with a modified valency-force potential function in which the Me group force consts. are those determined previously for C_2H_6. W. R. A.

Infra-red absorption spectrum of methylamine vapour. A. P. CLEAVES and E. K. PLYLER (J. Chem. Physics, 1939, **7**, 563—569).—The infra-red absorption of NH_2Me vapour (2—18 μ.) has been measured; of the 19 bands observed 9 have been assigned to fundamental vibrations. Several bands from 6 to 8 μ., which arise from the bending vibrations of the two groups, cause overlapping and render analysis in this region difficult. 3 bands due to CH vibrations appear between 3·0 and 3·6 μ., whilst the band due to NH parallel valency vibration is at 2·98 μ. The most intense band (12·9 μ.) arises from a bending vibration of the H atoms in the NH_2 group. The parallel vibration between the Me and NH_2 groups gives a parallel band at 9·56 μ. with a sharp and intense zero branch. The other bands observed have been assigned to over- and combination tones. W. R. A.

Infra-red absorption spectrum of *n*-pentane. G. A. STINCHCOMB (J. Chem. Physics, 1939, **7**, 853). —*n*-C_5H_{12} has been examined from 1 to 16 μ. Bands at 6·8, 7·2, and 7·9 μ. are doublets with a separation of ~10 cm.⁻¹ Between 8·0 and 8·5 μ. there are several ill-defined peaks separated by ~2·0 cm.⁻¹ Vals. of the least and greatest moments of inertia are computed and agree with vals. calc. for a mol. of W form. W. R. A.

Peculiarity in the infra-red absorption spectrum of germane. E. LEE and G. B. B. M. SUTHERLAND (Proc. Camb. Phil. Soc., 1939, **35**, 341—342).—Strong additional lines are found in the GeH_4 band at 2110 cm.⁻¹ (cf. A., 1936, 136). The lines are not due to an isotope, and are unlikely to be due to transitions from excited levels; they may be due to some perturbation of the rotational levels. F. J. L.

Infra-red absorption spectrum of tetradeuteroethylene. G. K. T. CONN and G. B. B. M. SUTHERLAND (Proc. Roy. Soc., 1939, **A, 172**, 172—193).—The absorption spectrum was studied in the range

1—19 μ. It is concluded that some of the current assignments of the fundamental frequencies of C_2H_4 are open to question. G. D. P.

Infra-red study of hydrazoic acid, HN_3. M. M. DAVIES (Trans. Faraday Soc., 1939, 35, 1184—1192).— The absorption spectrum of HN_3 in the region 2—21 μ. has been determined. Well-defined bands at 3·0, 4·35, 4·7, 8·0, and 8·7 μ. and weaker absorption near 18·5 μ. are observed. The 3·0 and 4·7 μ. bands have been examined with high dispersion. They are attributed respectively to the fundamental N–H vibration and to the unsymmetrical valency vibration of a linear N_3 group. The N–N linkings are both near to normal double bonds. A val. of ~70 × 10^{-40} was found for I_A from the fine structure of the 4·7 μ. band. F. J. G.

Absorption spectrum of nitrosyl chloride. C. F. GOODEVE and S. KATZ (Proc. Roy. Soc., 1939, A, 172, 432—444).—The prep. and method of purification of NOCl are described. The extinction coeff. was measured in the visible and ultra-violet, eleven bands being observed. The effect of temp. on these was investigated. G. D. P.

Spectral measurements with 0·2—0·5-mm. waves on high-frequency insulators and oxides. O. MAAR (Z. Physik, 1939, 113, 415—430).—The transmission of a no. of substances has been measured over the range 200—450 μ., using the high-pressure Hg arc and a metal foil laminar grating as source, and a radiometer for detection. The energy curve had its max. at 220 μ. L. G. G.

Fluorescence of glyoxal vapour. H. W. THOMPSON (J. Chem. Physics, 1939, 7, 855).—Glyoxal vapour shows two systems of absorption in the near ultra-violet at ~4600—3400 A. (discrete bands with fine structure) and ~3200—2300 A. (predissociated bands). The fluorescence of glyoxal vapour, excited by Hg lines from 3600 to 4400 A., shows a well-marked system of sharp bands between 4200 and 5200 A., the strongest band being ~4780 A. This band system is unlike the fluorescence emission spectrum of any other simple aldehyde or ketone. From the fine structure of certain absorption bands it is suggested that the moments of inertia indicate a *trans* form. W. R. A.

Fluorescence and photochemical kinetics of polyatomic molecules in the gas phase. W. A. NOYES, jun., and F. C. HENRIQUES, jun. (J. Chem. Physics, 1939, 7, 767—774).—A general discussion. W. R. A.

Polarisation of fluorescence of molecules in the vapour and in solution. F. SUPPE (Z. Physik, 1939, 113, 281—286).—The degrees of polarisation of the fluorescence of anthracene in the vapour and dissolved in glycerol are compared for different concns. (mol. per c.c.). Polarisations decrease with increase in concn. in either state, and are approx. equal at equal concn. L. G. G.

Response of several fluorescent materials to short-wave-length ultra-violet radiations. N. C. BEESE (J. Opt. Soc. Amer., 1939, 29, 278—282).— Efficiency curves for the excitation of fluorescence by λλ from 2200 to 3150 A. have been measured for artificial and natural willemite, Zn_2SiO_4 phosphors containing Mn and Cu, Cd borate containing Ni, $CaWO_4$, and $MgWO_4$ containing Cu. Similar curves for Zn_2SiO_4 and $CaWO_4$ have been measured down to 1000 A. by a photographic method. O. D. S.

Luminescence during intermittent optical excitation. R. P. JOHNSON and W. L. DAVIS (J. Opt. Soc. Amer., 1939, 29, 283—290).—Decay curves of the luminescence of artificial willemite, Zn silicate containing Be, Cd silicate containing Mn, $CaWO_4$, $MgWO_4$, and some sulphide mixtures have been investigated. A weak red phosphorescence of high persistence is produced in $CaWO_4$ and $MgWO_4$ by the addition of Sm. O. D. S.

Raman spectra of deuterium-substituted guanidine and carbamide. J. W. OTVOS and J. T. EDSALL (J. Chem. Physics, 1939, 7, 632).— Preliminary data on the Raman displacements and polarisations of aq. $C(NH_2)_2$:NH_2Cl and aq. $CO(ND_2)_2$ and comparison with H analogues are given. A strong parallelism exists between the data for $CO(NH_2)_2$ and $CO(ND_2)_2$ and those for $COMe_2$ and $CO(CD_3)_2$. W. R. A.

Fine structure of the Raman lines of carbon tetrachloride. A. C. MENZIES (Proc. Roy. Soc., 1939, A, 172, 89—94).—The intensities in the fine structure of the Raman line corresponding with the total symmetric vibration in CCl_4 were found to be consistent with a Cl isotope explanation, the analysis leading to an abundance ratio of 3·15, in agreement with the results obtained from mass spectra. The width of the total symmetric vibration Raman line in CCl_4 and in C_6H_6 is ~ twice that of the exciting line. G. D. P.

Structure of nitric acid and methyl nitrate. J. CHÉDIN (Mém. Poudres, 1939, 29, 111—133).— The Raman spectra of the NO_3' ion, HNO_3 (NO_2·OH), $MeNO_3$, McO·NO, and $EtNO_2$ are discussed in the light of old and new data. W. J. W.

Raman effect in samarium nitrate solutions. L. SIBAIYA and H. S. VENKATARAMIAH (Physical Rev., 1939, [ii], 56, 381).—A 40% solution with exciting line 4358 A. shows three new bands, approx. 950, 680, and 2770 cm.$^{-1}$ at their max. and not appearing at lower concns. They are tentatively ascribed to an electronic Raman effect in Sm^{+++} ions and the transitions responsible are indicated; the band widths are discussed. The rotational wing accompanying the incident radiation in the Raman spectrum of the dil. solution is entirely suppressed by the enhanced viscosity of the conc. solution. N. M. B.

Formation of HeH^+ molecules. M. B. M'EWEN and F. L. ARNOT (Proc. Roy. Soc., 1939, A, 172, 107—115).—The investigation was made with a mass spectrograph. HeH^+ is formed by collision between a singly-charged H_2 mol. and a normal He atom. The ionisation potential of the HeH mol. is 12 v. No evidence for the existence of HeH_2^+ was obtained. G. D. P.

Vitrification and crystallisation of organic molecules and the dielectric behaviour of *iso*butyl and *iso*amyl bromides. W. O. BAKER and

C. P. SMYTH (J. Amer. Chem. Soc., 1939, **61**, 2063—2071).—The dielectric consts. and sp. conductivities of $Bu^\beta Br$ and iso-$C_5H_{11}Br$ have been measured at 0·5, 5, and 50 kilocycles at temp. from $-190°$ to $30°$ above the m.p. The change from liquid to solid has been followed with a polarising microscope. On cooling, the liquids form glasses which crystallise at low temp.; their properties depend on the degree of crystallisation effected by the thermal treatment. It is concluded, from an examination of these and mols. previously studied (A., 1939, I, 453), that (i) moderately unsymmetrical mols. which pack efficiently in the liquid state should tend to vitrify, (ii) long-chain compounds, the mols. of which, in the liquid state, are already in a crystal-like array, set into the crystal lattice on cooling to the f.p. and do not form glasses, (iii) symmetrical mols. which form cubic lattices, and especially those which exhibit a rotational freedom in the crystal comparable with that in the liquid, do not generally supercool and thus do not form glasses, and (iv) mols. of symmetry between (i) and (ii) show degrees of supercooling varying with the shape of the mol., and rarely lead to true glass formation.   W. R. A.

Mechanism of orientation in *isobutyl* **and** *iso-amyl bromide glasses.* W. O. BAKER and C. P. SMYTH (J. Chem. Physics, 1939, **7**, 574—577).—Theoretical.   W. R. A.

Theory of electrical breakdown in ionic crystals. II. H. FRÖHLICH (Proc. Roy. Soc., 1939, **A**, 172, 94—106).—An expression is derived for the breakdown field strength of any polar crystal in terms of the optical properties, dielectric const., and mol. vol. Satisfactory agreement with experimental vals. is obtained (cf. A., 1937, I, 444).   G. D. P.

Dielectric breakdown in ionic crystals. (A) H. FRÖHLICH. (B) R. J. SEEGER and E. TELLER (Physical Rev., 1939, [ii], **56**, 349—352, 352—354).—(A) A crit. comparison of the Fröhlich (cf. A., 1937, I, 444) and the Seeger–Teller theories (cf. A., 1938, I, 601).
(B) A discussion of the above.   N. M. B.

Dielectric loss due to polar molecules in solid paraffin wax. D. R. PELMORE (Proc. Roy. Soc., 1939, **A**, 172, 502—517).—In confirmation of previous work, it is found that the dielectric loss in systems consisting of paraffin wax and an aliphatic ester is due to the rotation of the polar mols. Different waxes have been studied and it appears that the dielectric relaxation time depends mainly on the length of the C chains of the mols. of the shorter component. A suggestion is made as to the type of chain compound containing polar groups which should be most effective in low-loss dielectrics.   G. D. P.

Dielectric constants of liquids at radio frequencies : methyl alcohol, water, and methyl alcohol–water mixtures. III. Theoretical. IV. Experimental. T. T. JONES and R. M. DAVIES (Phil. Mag., 1939, [vii], **28**, 289—306, 307—327; cf. A., 1936, 271, 779).—The range (2·2—10·4) of ϵ previously covered has been extended to the region $\epsilon = 34$—81 with $MeOH$–H_2O mixtures. The detection of resonance, the effects of inductance in the leads, and the calculation of the resonance condition with the capacitance potential divider are considered. $\epsilon_{20°}$ and $\epsilon_{25°}$ are found to be 33·58 and 32·61 for $MeOH$, and 80·31 and 78·49 for H_2O, respectively. The results are compared critically with those obtained by other workers.   T. H. G.

Directive influence of the electric moment on substitution in the benzene ring. W. J. SVIRBELY (J. Amer. Chem. Soc., 1939, **61**, 2555).—If the electric moment of a monosubstituted C_6H_6 derivative is >2·07 D. the substituent group is m-directive, and if <2·07 D. is o- and p-directive (A., 1935, 684). This rule is obeyed by all compounds the electric moments of which have been determined since 1935.   W. R. A.

Solvent effect in dipole moment measurements. M. E. HOBBS (J. Chem. Physics, 1939, **7**, 849—850).—A modification of the equation of Böttcher (cf. A., 1938, I, 436) satisfactorily explains a considerable amount of data on the influence of solvents on orientation polarisation.   W. R. A.

Existence of rectilinear magnetic dichroism in liquids giving wide absorption bands. M. SCHÉRER (Compt. rend., 1939, **209**, 411—413).—Curves are given showing the variation with λ (4200—6200 A.) of the magnetic birefringence (β) and rectilinear dichroism (ρ) of aq. $Co(NO_3)_2$ (d 1·08). ρ has the same sign on either side of the absorption band, and is max. at ~5000 A. β is very small and has the same sign as in $PhNO_2$; an anomalous broad min. occurs at 5000 A. Relations between ρ, β, and the principal indices are given.   A. J. E. W.

Theory of electric polarisation, electro-optical Kerr effect, and electric saturation in liquids and solutions. A. PIEKARA (Proc. Roy. Soc., 1939, **A**, 172, 360—383).—The theory assumes the existence of two types of intermol. forces, and is compared with experimental data for solutions of $PhNO_2$ in hexane.   G. D. P.

Intensities of electronic transitions in molecular spectra. VIII*a*. Odd-numbered conjugated polyene chain molecules and organic dyes (with notes on optical anisotropy and Raman intensities). R. S. MULLIKEN (J. Chem. Physics, 1939, **7**, 570—572; cf. A., 1939, I, 353).—Application of the Hückel mol. orbital approximation shows that the lowest excited electronic levels and the long-λ electronic spectra should exhibit the same features for conjugated polyene chain mols. with an odd no. (many dye mols.) as for an even no. of atoms (carotenoids) in the conjugated chains. The absorption and refraction of carotenoid crystals are discussed, and the Raman intensities of conjugated chain mols. considered.   W. R. A.

Normal modes of vibration of a body-centred cubic lattice. P. C. FINE (Physical Rev., 1939, [ii], **56**, 355—359).—Mathematical. From the theory developed, numerical computations for W yield a frequency distribution characterised by two steep max. This is used in evaluating the sp. heat and the intensity of reflexion of X-rays as functions of temp., and results are compared with the Debye theory.   N. M. B.

Normal modes of oscillation of the long-chain paraffin hydrocarbons. L. H. THOMAS and S. E. WHITCOMB (Physical Rev., 1939, [ii], **56**, 383).— Mathematical. The results have been applied to the infra-red data (1—15 μ.) on $C_{11}H_{24}$. N. M. B.

Anharmonicity of CH vibrations and product rule. O. REDLICH (J. Chem. Physics, 1939, **7**, 856). —The isotope product rule for H and D analogues has been applied to 21 compounds. The differences between the calc. and observed vals., and the suggested corrections for anharmonicity, are given. Individual discrepancies are least for totally symmetrical frequencies, which can be usually determined more precisely. For 10 examples involving only a bending frequency a small negative anharmonicity factor is indicated. Since the third-order term in a power series of the potential energy must result in a positive val. of this factor (A., 1936, 142), the third-power term is either zero or small, as is expected. W. R. A.

Coriolis perturbations in the methane spectrum. IV. Four general types of Coriolis perturbation. H. A. JAHN (Proc. Roy. Soc., 1939, A, **171**, 450—468; cf. A., 1939, I, 119, 300).—It is shown that four distinct types of Coriolis perturbation of an infra-red-active vibrational level are possible in a tetrahedral mol. The formulæ derived form the basis for an analysis of any infra-red absorption band of CH_4. G. D. P.

Polarisation and resonance in the study of aromatic nuclei. Benzene and substituted benzenes. G. B. BONINO (Gazzetta, 1939, **69**, 417—435).—An extension of the author's earlier views concerning the nature of polarisation and resonance phenomena in substituted benzenes. The graphical representation of the C_6H_6 ring and of polarisation effects in the aromatic C to C link is discussed in relation to the wave-mechanical treatment. O. J. W.

Rotational partition function of the water molecule. C. C. STEPHENSON and H. O. McMAHON (J. Chem. Physics, 1939, **7**, 614—615).— By summing the experimentally observed energy levels of Randall *et al.* (A., 1937, I, 495), the rotational contribution to the partition function of the H_2O mol. has been computed for temp. up to 298·1° K. The stretching contribution has been determined by comparison of these data with those for a rigid rotator. The theoretical stretching correction of Wilson (A., 1936, 1190) has been confirmed. W. R. A.

Calculation of bond strength in methane. H. A. TAYLOR and M. BURTON (J. Chem. Physics, 1939, **7**, 572—573).—The C·H bond strength in CH_4, recomputed from recent data by the Voge method (A., 1936, 1324), is ~103 kg.-cal., in agreement with 94·8 kg.-cal. calc. by Burton (A., 1939, I, 62). W. R. A.

Possible significance of the natural polymorphic system. C. WEYGAND (Z. ges. Naturwiss., 1937, **2**, 404—408; Chem. Zentr., 1937, i, 2570; cf. A., 1936, 1484).—A discussion of the degree and type of association in org. compounds. A. J. E. W.

Surface states associated with a periodic potential. W. SHOCKLEY (Physical Rev., 1939, [ii], **56**, 317—323).—Mathematical. The wave functions and energy levels associated with a finite one-dimensional periodic potential field are investigated. Results extended to three dimensions indicate that the surface levels give rise to surface bands. These probably exist and are half-filled for diamond. They exist for all metals and are unoccupied only for the univalent metals. N. M. B.

Use of surface states to explain activated adsorption. W. G. POLLARD (Physical Rev., 1939, [ii], **56**, 324—336; cf. preceding abstract).—A theory connecting activated adsorption with electron surface states in solids is developed, and the mechanism in the case of H_2 is given. Results appear to account for the observed heats of activated adsorption of H_2. N. M. B.

Structure of liquid potassium. N. S. GINGRICH and C. N. WALL (Physical Rev., 1939, [ii], **56**, 336—339).—The Wall method for calculating the free vol. per atom in a liquid (cf. A., 1939, I, 133) with the help of the at. distribution curves at 70° and 395° is applied to liquid K. From the free vols. at these temp. the entropies of the liquid at the m.p. and b.p. are obtained. These vals., with the entropies of solid K at its m.p. and of K vapour at its b.p., give the entropies of fusion and vaporisation. Hence the calc. latent heats of fusion and vaporisation are 2·06 and 87·5 kilojoules per mol., respectively, compared with the respective observed vals. 2·38 and 84·0 kilojoules per mol. N. M. B.

Melting as an order–disorder transition. G. H. WANNIER (J. Chem. Physics, 1939, **7**, 810—817).—By assuming idealised forces between atoms, the breakdown of a regular crystal pattern of an at. crystal of the diamond type has been investigated theoretically and the motion of a limited no. of particles is studied. Although the method is not likely to have quant. application it shows (i) that the sharp m.p. of a crystal is due to the breakdown of cryst. long-distance order, (ii) the close connexion between order–disorder transitions in alloys and melting, (iii) that repulsive forces between atoms and the harmonic character of their attraction are of secondary importance, and (iv) that m.p. and latent heat vals. are of the right order of magnitude. Reasons are discussed for thermodynamic inconsistencies which arise. W. R. A.

Thermodynamics of crystals and melting. M. BORN (J. Chem. Physics, 1939, **7**, 591—603). W. R. A.

Apparent shape of protein molecules.—See A., 1939, III, 938.

Arrangement of substituents in cellulose derivatives. H. M. SPURLIN (J. Amer. Chem. Soc., 1939, **61**, 2222—2227).—Calculations indicate that substituents in a cellulose derivative are distributed fortuitously among the OH groups, and that the three types of OH are substituted to an extent dependent on the relative reactivities of these groups and on the nature of the reaction. Available experimental data confirm this view. W. R. A.

"Effective electron density" and chemical behaviour. H. F. TSEOU (J. Amer. Chem. Soc., 1939, **61**, 2161—2163).—The "effective electron density" of an element is the ratio n/r, where n is the no. of valency electrons and r the effective co-valent at. radius. For doubly- and triply-bonded atoms r becomes < and hence n/r > for singly-bonded atoms. High vals. of n/r are associated with high electronegativity. Elements having intermediate vals. tend to form stable polyat. chains. Covalent links between atoms of high and low n/r vals. degenerate to ionic links.   W. R. A.

Forces in molecules. R. P. FEYNMAN (Physical Rev., 1939, [ii], **56**, 340—343).—Mathematical. Formulæ for calculating the forces in a mol. system directly, rather than indirectly through energy, are developed. The force on a nucleus in an at. system is shown to be just the classical electrostatic force that would be exerted on this nucleus by other nuclei and by the charge distribution of the electrons.   N. M. B.

Heavy water Rochelle salt. A. N. HOLDEN, G. T. KOHMAN, W. P. MASON, and S. O. MORGAN (Physical Rev., 1939, [ii], **56**, 378).—Replacing the H_2O of crystallisation by D_2O raises the upper and lowers the lower crit. temp. at which abrupt changes in the dielectric and piezoelectric properties occur. With 99·5% D_2O the respective changes are 23·5° to 34·5° and $-19°$ to $-24°$. The vals. of the dielectric const. and the piezoelectric const. which exhibit the crit. temp. are reduced at temp. between the Curie points to ~75% of the H_2O crystal vals.   N. M. B.

Optical surface thickness of pure water. J. W. MCBAIN, R. C. BACON, and H. D. BRUCE (J. Chem. Physics, 1939, **7**, 818—823).—Details are given of an apparatus capable of measuring unimol. surface film thicknesses. The method has been applied to pure H_2O and gives 2—3 A. for the min. thickness of the H_2O surface. The ellipticity from H_2O at the polarising angle is estimated at between 33 and 42 × 10⁻⁵.   W. R. A.

Physico-chemical studies of α- and β-elæo-stearic acids. I. Molar refractivity and parachor. S. W. WAN and M. C. CHEN (J. Amer. Chem. Soc., 1939, **61**, 2283—2284).—d, σ, n, and parachor are given for α-, new m.p. 49·0—49·2°, and β-elæo-stearic acid, new m.p. 71·5—72·0°. An unexplained difference in parachors exists.   R. S. C.

Proof of the mathematical identity of the equations of Laue and Bragg's relationship. A. CAVINATO (R. C. Atti Accad. Lincei, 1939, [vi], **29**, 319—321).—The conditions for positive interference of X-rays at a space lattice given by Laue and by Bragg are shown to be mathematically identical.   O. J. W.

Diffraction of X-rays by crystals at elevated temperatures. G. D. PRESTON (Proc. Roy. Soc., 1939, **A**, **172**, 116—126).—In addition to the normal Laue spots, crystals of Al, NaCl, and MgO exhibit diffuse reflexions the intensity of which increases as the temp. of the crystal is raised. The presence of the diffuse spots is interpreted as being due to the thermal vibrations of the crystal lattice.   G. D. P.

Microscopy of picrolonates of amino-acids.—See A., 1939, II, 470.

X-Ray investigation of the structure transition of methane at the λ point. A. SCHALLAMACH (Proc. Roy. Soc., 1939, **A**, **171**, 569—578).—Below and above the λ point, ~20·4° κ., CH_4 crystallises in a face-centred cubic lattice. In the neighbourhood of the λ point some additional X-ray reflexions are observed, and the lattice const. is abnormally large. It is concluded that the extra lines indicate the presence of a structure existing only in the vicinity of the λ point.   G. D. P.

X-Ray investigation of structure of boron nitride. A. C. BREGER (J. Phys. Chem. Russ., 1939, **13**, 559; cf. A., 1938, I, 300).—The space-group is C^4_{6v}.   R. C.

Lower limiting crystallite size and internal strains in some cold-worked metals. W. A. WOOD (Proc. Roy. Soc., 1939, **A**, **172**, 231—241).—Measurement of the line breadth in the X-ray spectra of Cu, Ni, Ag, Al, Mo, and Fe, cold-worked by rolling, showed that there is a lower limiting crystal size varying from 10⁻⁴ cm. for Al to 7 × 10⁻⁶ cm. for Cu. The cold-worked metal has two extreme conditions: (1) stable state with contracted lattice and min. line breadth (lower limit of crystallites), and (2) a less stable expanded lattice giving diffuse, broad lines.   G. D. P.

X-Ray investigation of titanium nitride. I. Structure of single crystals. A. C. BREGER (J. Phys. Chem. Russ., 1939, **13**, 272—275).—TiN has a face-centred lattice with the spacing 4·22 A. not in agreement with the density 4·73.   J. J. B.

Arrangement of the micro-crystals of silver bromide electro-deposited on the anode silver plate. S. SHIMADZU (Mem. Coll. Sci. Kyoto, 1939, **A**, **22**, 27—33).—The micro-crystals of AgBr deposited on a Ag anode from 0·1N-KBr solution, slightly acid (*a*) or alkaline (*b*), have been examined using oblique Cu $K\alpha$ X-rays. The micro-crystals on an annealed Ag anode from (*a*) showed no trace of fibrous arrangement and gave rise to Debye–Scherrer rings, but on a rolled anode fibrous arrangement occurs parallel to the direction of rolling; the fibre axis is [110] and the cubic face (001) is parallel to the plate. In (*b*) a fibrous arrangement of micro-crystals is obtained on an annealed anode, the fibre axis [110] being perpendicular to the anode surface. The arrangement is similar on the rolled anode. The effect of c.d., concn., and temp. has also been investigated.   F. J. L.

Twins of α-quartz obtained after temporary conversion into the β-form. J. P. PÉREZ (Compt. rend., 1939, **209**, 173—175).—Conversion of homogeneous twinned quartz (I) plates into the β-form by heating at >575°, followed by cooling and re-transformation into α-(I), produces heterogeneity, revealed by etching with HF. Each element of β-(I) crystal may give α-(I) with either of two orientations about the fixed optic axis, and the choice of orientation is apparently governed by mechanical strain in the crystal.   A. J. E. W.

Structure of formaldehyde from electron diffraction. D. P. STEVENSON, J. E. LUVALLE, and V. SCHOMAKER (J. Amer. Chem. Soc., 1939, **61**, 2508—2510).—Using electrons ($\lambda = 0.0611$ A.) electron diffraction patterns of monomeric CH_2O have been obtained from which the val. 1.21 ± 0.01 A. is deduced for the C=O distance. Combining this val. with known moments of inertia, the following structural consts. have been found : C—H = 1.09 ± 0.01 A.; angle H–C–H = $120 \pm 1°$.   W. R. A.

Ferromagnetism in austenite. L. P. TARASOV and E. R. PARKER (Physical Rev., 1939, [ii], **56**, 379). —A steel containing Ni 1.97, Cr 0.86, Mo 0.35, and C 0.28% is exceptional in being ferromagnetic while in the austenitic (γ-phase) condition. Ferromagnetism first appeared at 750° on cooling, and the variation of magnetic intensity with temp. on heating and on cooling in H_2 is plotted. The $\gamma \to \alpha$ phase transformation is at 520—340°.   N. M. B.

Diamagnetic anisotropy of organic molecules. K. LONSDALE (Proc. Roy. Soc., 1939, A, **171**, 541—568).—The principal diamagnetic susceptibilities of single crystals of a no. of long-chain compounds, layer structures, and aromatic compounds were measured, and compared with the optical properties and mol. structure of the crystals. Long-chain compounds and layer structures containing few or no double linkings show negative magnetic birefringence. Aliphatic mols. containing acetate or acid groups, or chains of conjugated double and single linkings, and aromatic mols. with aliphatic conjugated side-chains show positive magnetic birefringence.   G. D. P.

Time effects in the magnetic cooling method. H. N. V. TEMPERLEY (Proc. Camb. Phil. Soc., 1939, **35**, 256—264).—Theoretical. A new mechanism of interaction between ion and lattice is possible in consequence of the magnetic and exchange interactions between the ions of a paramagnetic salt, involving the simultaneous transition of two or more ions with the emission or absorption of only one elastic quantum. The mechanism has been applied to Cs Ti alum.   F. J. L.

Heating of iron ammonium alum by alternating magnetic fields at very low temperatures. E. S. SHIRE and H. M. BARKLA (Proc. Camb. Phil. Soc., 1939, **35**, 327—335).—The irreversible heating of Fe NH_4 alum is similar to that arising from hysteresis in ferromagnetics, and $\propto$ frequency of the field. No remanence could be detected by the ballistic method at 0.075° K. The rate of heating was much increased by superposition of a steady magnetic field of a few hundred gauss.   F. J. L.

Electrical phenomenon in crystallisation. A. TSCHERMAK-SEYSENEGG (Forsch. u. Fortschr., 1939, **15**, 284—285).—An extension of work already noted (*ibid.*, 1931, **7**, 254).   W. R. A.

Mean free path of electrons in polar crystals. H. FRÖHLICH and N. F. MOTT (Proc. Roy. Soc., 1939, A, **171**, 496—504).—Expressions are obtained for the mean free path and mobility in a polar crystal of electrons which have been raised into the normally empty conduction band of energy levels by absorption of light or by thermal agitation of the atoms. The

theory is compared with experimental data for the photoconductivity of NaCl, and with vals. of the mobility, derived from the Hall const. and the sp. conductivity, in Cu_2O.   G. D. P.

Electronic states at the surfaces of crystals. I. Approximation of nearly free electrons. II. Approximation of tight binding : finite linear chain of atoms. III. Approximation of tight binding : further extensions. E. T. GOODWIN (Proc. Camb. Phil. Soc., 1939, **35**, 205—220, 221—231, 232—241; cf. A., 1939, I, 513).—I. Theoretical. In a crystal states exist in which the electron is bound to the surface of the crystal and has an energy lying within a forbidden band. The wave functions and energy states are calc. in terms of a Fourier series with the lattice periodicity.

II. Normal and surface electronic states are discussed.

III. The surface states of a simple cubic crystal are determined on the approximation of tight binding. The *s*- and *p*-states of a semi-infinite chain are regarded as degenerate, the existence of surface states being predicted.   F. J. L.

Nature of *U*-centres in alkali halide crystals. R. HILSCH and R. W. POHL (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, **2**, 139—143; Chem. Zentr., 1937, i, 2549).—The *U*-centres are alkali hydride mols. formed in the crystal by interaction of H_2 with excess of alkali metal atoms; colour centres can be quantitatively converted into *U*-centres.   A. J. E. W.

Piezoelectricity of potassium phosphate. W. LÜDY (Z. Physik, 1939, **113**, 302—305).—The modulus d_{36} of KH_2PO_4 is measured by a static method from room temp. to that of liquid air. The modulus at room temp. is similar to that of quartz, but with fall in temp. a rise occurs until near the upper Curie point the max. val. of $32,500 \times 10^{-8}$ e.s.u. per dyne is sharply reached at 123° K. Below 123° K. the modulus falls slowly and it is suggested that at the lower Curie point a rise would again occur.   L. G. G.

Morphological constants of double salts of the type $R^{II}SO_4$,(piperazine,H_2SO_4),$6H_2O$. E. STOICOVICI and S. VON GLISZCZYNSKI (Zentr. Min., 1937, A, 13; Chem. Zentr., 1937, i, 2551).—The crystals are monoclinic holohedral, space-group C_{2h}. Data are given for R^{II} = Cu, Mg, Ni, Co, Zn, Fe, Mn, and Cd. The Mg, Ni, and Cd, and the Co, Zn, and Mn salts form isomorphous groups.   A. J. E. W.

Crystallographic study of sucrose. V. Crystals from solutions of different purity ; twinning types. G. VAVRINECZ (Magyar Chem. Fol., 1936, **42**, 124—138; Chem. Zentr., 1937, i, 1692; cf. A., 1934, 18).—Morphological data are given for sucrose crystals from different stages of manufacture, and the twin formations are studied.   A. J. E. W.

Dependence of modulus of elasticity, elastic limit, breaking strain, and total extension of palladium on the content of hydrogen at different temperatures. H. JUNGNITZ (Z. tech. Physik, 1939, **20**, 161—169).—The elastic behaviour of Pd containing H_2 was determined for different [H_2]

and at various temp. up to ~200°. The variation of breaking strain with temp. for pure Pd is ascribed to structural changes in the metal. The earlier observation of an increase in breaking strain with increasing [H_2] at room temp. could not be confirmed at 52°; there is an immediate decrease in the breaking strain on absorption of H_2. For the same [H_2] the extent of the decrease in breaking strain increases with rise of temp. This is ascribed to the fact that the larger space lattice of Pd at higher temp. offers less resistance to the expansion of the absorbed H_2, and that the expanding force of the H_2 itself increases with temp. The curves of breaking strain against temp. for different [H_2] are approx. parallel except for low [H_2]. The results are discussed in connexion with the work of Lacher (A., 1938, I, 24) on the structure of the Pd–H_2 system.   A. J. M.

Intercrystalline thermal currents as a source of internal friction. R. H. RANDALL, F. C. ROSE, and C. ZENER (Physical Rev., 1939, [ii], **56**, 343—348; cf. A., 1938, I, 131).—An experiment was designed, using single-phase brass with mean grain size varying in small steps over a wide range, and with a range of frequencies, to detect the contribution of intercryst. thermal currents to the internal friction of polycryst. metals. Results indicate that in annealed non-ferromagnetic metals at room temp., intercryst. thermal currents are the main cause of internal friction measured at small strains, apart from possible macroscopic thermal currents.   N. M. B.

Mechanism of sliding on ice and snow. F. P. BOWDEN and T. P. HUGHES (Proc. Roy. Soc., 1939, A, **172**, 280—298).—Experiments show that the low coeff. of friction observed near the m.p. is due to lubrication by a H_2O film formed by frictional heating. Experiments with model and full-size ski on snow surfaces showed that the same general laws were obeyed. The friction depends on the thermal conductivity of the ski.   G. D. P.

Electrical conductivity of thin films of mercury. E. T. S. APPLEYARD and J. R. BRISTOW (Proc. Roy. Soc., 1939, A, **172**, 530—539).—The films were deposited in high vac. on surfaces cooled to temp. between 20·4° and 90° K. As deposition proceeds, the Hg collects as solid droplets and the conductivity of the film suddenly increases when the droplets touch each other. The temp. coeff. of resistance was studied, and it was concluded that films >500 A. thick, deposited below 64° K., are coherent slices of metal.   G. D. P.

Superconductivity of thin films. I. Mercury. E. T. S. APPLEYARD, J. R. BRISTOW, H. LONDON, and A. D. MISENER (Proc. Roy. Soc., 1939, A, **172**, 540—558).—When annealed at 90° K. or more, Hg films of 250—10,000 A. in thickness behave in the same way as the bulk metal. The transition temp. is displaced downwards for films prepared at 4·2° K. and not afterwards annealed. The crit. magnetic fields required to restore normal conductivity in the films at various temp. were determined. It is inferred that the depth of field penetration increases as the transition temp. is approached.   G. D. P.

Electric waves in single and parallel wires. Permeability of iron and nickel. K. F. LINDMAN (Z. tech. Physik, 1939, **20**, 185—188).—The determination of the λ of electric waves in very thin single and parallel wires of manganin, Fe, and Ni shows that this is the same in both systems. Vals. for the permeability of Fe and Ni previously calc. (cf. A., 1939, I, 130) from the λ of electric waves in a system of parallel wires, based on a formula originally derived for single wires, are therefore confirmed. The existence of overtones in the wires was noted, but these do not affect the determinations.   A. J. M.

Ferromagnetic impurities. I. F. W. CONSTANT and J. M. FORMWALT (Physical Rev., 1939, [ii], **56**, 373—377; cf. A., 1938, I, 273).—A detailed account of results previously reported.   N. M. B.

Magnetism of chlorides of the palladium and platinum triads of elements. B. CABRERA and A. DUPERIER (Proc. Physical Soc., 1939, **51**, 845—858).—Using a high-sensitivity torsion balance with electromagnetic compensation and a special electromagnet, measurements on the variation of the magnetic susceptibility of $RhCl_3$, $OsCl_2$, $IrCl_3$, and $PtCl_2$ for temp. up to ~300° are reported. Results for corresponding cations can be represented by an equation of the type $(\chi + K)(T + \Delta) = C$.   N. M. B.

Magnetic properties of myoglobin and ferri-myoglobin, and their bearing on the problem of the existence of magnetic interactions in hæmoglobin. D. S. TAYLOR (J. Amer. Chem. Soc., 1939, **61**, 2150—2154).—The magnetic moments of the Fe atoms in ferro- and ferri-myoglobin are 5·46 and 5·85 Bohr magnetons, respectively. Following the manner of interpretation employed for ferro- and ferri-hæmoglobin (cf. A., 1938, I, 293), these data indicate that the Fe atoms are held to the porphyrin by essentially ionic bonds. The agreement between the experimental and calc. vals. of the magnetic moments for ferro- and ferri-hæmoglobin shows that there is little or no magnetic interaction between the 4 hæms in hæmoglobin.   W. R. A.

Ultrasonic dispersion in liquids. L. ZACHOVAL (J. Phys. Radium, 1939, [vii], **10**, 350—354).—The velocity v of ultrasonic waves in $COMe_2$, glycerol, $MeOAc$, $PhNO_2$, CCl_4, $PhMe$, and castor oil (A., 1939, I, 189) has been measured at different frequencies by a method which is described. A systematic variation of v with the frequency has been found in most cases.   W. R. A.

Sonoluminescence and sonic chemiluminescence. E. N. HARVEY (J. Amer. Chem. Soc., 1939, **61**, 2392—2398).—Sonoluminescence is observed with pure H_2O in presence of air, O_2, Ne, and N_2 (weakly) but not in purified H_2. Br–H_2O also emits a bright light when subjected to supersonic fields in N_2 but not in H_2. These facts suggest that the luminescence is not due to oxidation but is connected with the development of balloelectric potentials which are large in N_2 and small in H_2. The occurrence of luminescence in pure N_2 shows also that activation of dissolved O_2 is not involved. The production of luminescence can therefore be represented as the collapse of minute charged bubbles of cavitated gas

with consequent decrease in capacity and increase in voltage until a discharge takes place in the gas of the bubble, with emission of light. If O_2 is present in the liquid the discharge would lead to its activation with consequent formation of H_2O_2 or direct chemical reaction with any compounds present in solution, e.g., aminophthalhydrazide, with production of sonic chemiluminescence. This effect is independent of the substances dissolved in H_2O but is quenched by high v.p. of H_2O (rise in temp.) or by sp. volatile org. compounds. W. R. A.

Optical investigation of oxide films on metals. C. E. LEBERKNIGHT and B. LUSTMAN (J. Opt. Soc. Amer., 1939, 29, 59—66).—Plane polarised light directed on to Fe and Ni oxide films of various thicknesses throughout the temper-colour range is elliptically polarised owing to multiple reflexions within the films. A method for measuring the rate of formation of an oxide film of any composition in the temper-colour range is developed. The refractive index of the film on Fe is complex, and the optical consts. of pure Fe vary with temp. The multiple reflexion theory gives the same results as the Drude transition layer theory. F. J. L.

Optical properties of sulphamic acid. W. M. D. BRYANT (J. Amer. Chem. Soc., 1939, 61, 2551).—$NH_2 \cdot SO_3H$ has n_α^{25} 1·553±0·003, n_β^{23} 1·563±0·003, n_γ^{25} 1·568±0·003; optic axial angle : $2H_a = 65\pm1°$, $2H_0 = 120\pm5°$, $2V = 64°$ (calc. from $2H_a$ and $2H_0$ by the tangent relation) and 63° (calc. from $2H_a$ and β); dispersion weak and indeterminate; optical character negative; crystal system orthorhombic bipyramidal; crystal habit : tablets and compact prisms from cold aq. solution, large lozenge-shaped plates on cooling hot aq. solution ; fused material is glassy; optical orientation : optic axial plane coincides with the principal pinacoid which is 001 or 010, and the obtuse bisectrix apparently coincides with the a axis for both settings. W. R. A.

Dispersion and transmission of methyl methacrylate polymeride. A. H. PFUND (J. Opt. Soc. Amer., 1939, 29, 291—293).—Dispersion has been measured for 11 Hg lines between 3130 and 10,140 A. Transmission has been measured between 2900 and 22,000 A. O. D. S.

Propylene. Heat capacity, vapour pressure, heats of fusion and vaporisation. Third law of thermodynamics and orientation equilibrium in the solid. T. M. POWELL and W. F. GIAUQUE (J. Amer. Chem. Soc., 1939, 61, 2366—2370).—The m.p. and b.p. of C_3H_6 are 87·85° and 225·35° K., respectively; v.p. (between 166 and 226° K.) is $\log_{10} P$ (internat. cm. Hg) $= 1196·9/T - 3·92 \times 10^{-3}T + 8·07544$; gas density, 1·7461 g./l. at 25° and 1 atm.; C_p has been determined from 14·18° K. to b.p. The heats of fusion and vaporisation are 717·6 and 4402 g.-cal. per mol., respectively. The entropy at the b.p., calc. from calorimetric data, is 59·93 g.-cal. per degree per mol. compared with 61·0±0·3 calc. from mol. data. This discrepancy is explained as due to random end-for-end orientation of $CH_2 \cdot CHMe$ mols. in the crystal lattice. The most accurate val. for

$S_{298·1}$ is 64·0 g.-cal. per degree per mol., calc. from mol. data. W. R. A.

Heat capacities of titanium dioxide from 68° to 298° K. Thermodynamic properties of titanium dioxide. H. J. McDONALD and H. SELTZ (J. Amer. Chem. Soc., 1939, 61, 2405—2407).—C_p for TiO_2 has been measured from 68° to 298° K. and from these data the entropy of TiO_2 at 298·1° K. is 12·45 e.u. For Ti (s) + O_2 (g) = TiO_2 (rutile), $\Delta S_{298·1} = -43·18$ e.u., $\Delta H_{298·1} = -225,300$ g.-cal., $\Delta G_{298·1} = -212,430$ g.-cal. These data are applied to the problem of the deoxidation of Fe by Ti. W. R. A.

Thermodynamic properties of hydrogen fluoride and fluorine from spectroscopic data. G. M. MURPHY and J. E. VANCE (J. Chem. Physics, 1939, 7, 806—810).—Vals. of $-(G° - H_0°)/T$, $S°$, and $C_p°$ have been calc. from 298·1° to 2000° K. for HF from spectroscopic data and for F_2 from a combination of spectroscopic data, electron diffraction data, and Badger's rule. Using these vals. and thermal data, vals. of $\Delta G°$ have been calc. for the reactions $\frac{1}{2}H_2 (g) + \frac{1}{2}F_2 (g) \rightleftharpoons HF (g)$ and $F_2 \rightleftharpoons 2F$. W. R. A.

Chlorine. Heat capacity, vapour pressure, heats of fusion and vaporisation, and entropy. W. F. GIAUQUE and T. M. POWELL (J. Amer. Chem. Soc., 1939, 61, 1970—1974).—The m.p. of Cl_2 is 172·12° and the b.p. 239·05° K. The triple point pressure is 1·044 cm. Hg. The v.p. of Cl_2 from 172·12° to 240·05° K. is $\log P$ (internat. cm. Hg) $= -1414·8/T - 0·01206T + 1·34 \times 10^{-5}T^2 + 9·91635$. Vals. of C_p for Cl_2 from 14·05° to 239·05° K. have been found using the Au calorimeter and technique already described (A., 1937, I, 123). The heats of fusion and vaporisation are 1531±1 and 4878±4 g.-cal. per mol., respectively. Applying the third law of thermodynamics the entropy corr. to the ideal gas state at 239·05° and 298·10° K. is 51·56 and 53·32 g.-cal. per degree per mol. compared with the vals. 51·55 and 53·31 calc. for the same temp. from spectroscopic data. W. R. A.

Variation with temperature of the true specific heat of pure copper and aluminium up to their m.p. A. AVRAMESCU (Z. tech. Physik, 1939, 20, 213—217).—Cold-drawn wires were heated by a current so that they melted in 1—2 sec. From the variation of current and potential obtained by an oscillograph, the quantity of heat taken up and the temp. attained, and hence the heat capacity, could be calc. The true sp. heat of Cu and Al at high temp. increases steadily with temp. For Cu at 1000° the sp. heat is 1·47 times that at 0°, and that of Al at 600° is 1·26 times that at 0°; in both cases the variation is almost linear. A. J. M.

Stoicheiometry. III. Influence of molecular structure on latent heat of fusion. New mesomorphic state. A. VAN DE VLOED (Bull. Soc. chim. Belg., 1939, 48, 229—268; cf. A., 1937, I, 12).—Comparison of thermal data with crystal structure data for various org. compounds shows that the val. of the entropy of fusion (σ) is determined solely by the spatial structure of the mol., and the latent heat of fusion (Q) depends solely on the m.p. and on the mol. structure at the m.p., thus confirming Pirsch's hypo-

thesis. The variations in σ and Q on substituting atoms and at. groups into hydrocarbons is discussed. Evidence in support of Timmermans' discovery (cf. A., 1939, I, 65) of a new mesomorphic state, in which solids possess some of the properties of liquids, is produced. C. R. H.

Total and partial emissive power of some substances. I, II. A. CARRELLI (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 241—247, 381—388).—I. The emission of radiation as a function of temp. is calc. thermodynamically.

II. Vals. are recorded for the emissive power (E) of Pt, LiCl, NaCl, KCl, ZnO, CaO, MgO, and CoO at various temp. In general the relation between $\log E$ and $\log T$ is linear. O. J. W.

Spectral emissivity and relation of true temperatures and brightness temperatures of platinum. R. E. STEPHENS (J. Opt. Soc. Amer., 1939, **29**, 158—161).—The spectral emissivity of Pt for λ 6600, measured by comparison of the surface brightness of a tubular filament with that of a small hole in the wall of the tube by means of an optical pyrometer, varies linearly with temp. from 0·283 at 1200° K. to 0·295 at 1900° K. The surface brightness has a max. 1·24 times the normal val. at an emission angle of 80°. L. J. J.

Total thermal emission of nickel. F. CENNAMO (Nuovo Cim., 1939, **16**, 147—154).—The total thermal emission (E) of Ni has been measured for the range 250—750°. The slope of $\log E$ plotted against $\log T$ decreases from 5·15 below 340° to 4·45 at 340—350° (the Curie point) and above. This is not entirely accounted for by the change in the sp. resistance of Ni at about this point. O. J. W.

Upper limit of the absolute temperature. B. PTÁČEK (Chem. Obzor, 1939, **14**, 129).—The upper limit of abs. temp. is calc. to be $1·08 \times 10^{13°}$ K. F. R.

Pressure–volume–temperature relations for gaseous monomethylamine. C. T. KENNER and W. A. FELSING (J. Amer. Chem. Soc., 1939, **61**, 2457—2459).—Pressure-vol.-temp. relations for gaseous NH_2Me have been measured from 60° to 225°, sp. vol. from 27 to 107 c.c. per g., and pressure from 7·5 to 38 atm. An equation $p = RT/(v - \delta) - 17{,}940/(v + 1·759)^2$, where $\log_{10} \delta = 1·0548 - 6·120/v$, has been applied to these data and reproduces the observed pressures satisfactorily. W. R. A.

Vapour pressure curve of liquid helium below the λ point. B. BLEANEY and F. SIMON (Trans. Faraday Soc., 1939, **35**, 1205—1214).—A rational v.p. curve for He below the λ point is calc. Down to 1·6° K. it agrees with the vals. of Schmidt and Keesom (A., 1938, I, 21), but then deviates towards lower pressures. F. J. G.

Vapour pressure of salts at high temperatures. I. I. NARISHKIN (J. Phys. Chem. Russ., 1939, **13**, 528—533).—The v.p. of NaCl, KCl, KF, NaF, and AlF_3 have been measured at 750—1000°, and the b.p. and mol. heat of vaporisation calc. from the results. R. C.

Equation of state of frozen neon, argon, krypton, and xenon. G. KANE (J. Chem. Physics, 1939, **7**, 603—613).—The potential energy between two rare gas atoms is $Q = -Ar^{-6} + ABe^{-r/\rho}$, where the first term is the van der Waals attraction energy and the second is the energy of repulsion. Vals. of A and B have been calc. from lattice consts. and heats of sublimation of frozen Ne, A, Kr, and Xe for $\rho = 0·2091$ and 0·345 A.; equations of state of the solids are calc. For Kr the calc. vals. of the coeff. of thermal expansion and of sp. heat are $>$ experimental vals. at higher temp. W. R. A.

Corresponding states for perfect liquids. K. S. PITZER (J. Chem. Physics, 1939, **7**, 583—590).—Theoretical. A derivation of the theory of corresponding states, based on classical statistical mechanics, is given for perfect liquids, assuming (i) spherical mol. symmetry, (ii) intramol. vibrations are the same whether the substance is in the liquid or gaseous states, (iii) the potential energy of an assemblage of mols. is a function only of various intermol. distances, (iv) the potential energy of a pair of mols. is $E = AQ(R/R_0)$, where Q is a universal const., R is the intermol. distance, and A and R_0 are particular consts., here taken as respectively the crit. temp. and the cube root of the crit. vol. A, Kr, and Xe conform closely to the assumptions and show the predicted correspondence. It is concluded that all "perfect" liquids will freeze into closest-packed (face-centred) crystals and that the entropy of fusion and triple point temp. will show regularities. With imperfect liquids deviations are encountered and imperfections cause deviations in all properties, thereby rendering it difficult to specify proper conditions of comparison. Heat capacity and entropy of vaporisation are selected as the properties sensitive to imperfection and insensitive to temp., and the deviations of a large no. of mols. are discussed. Deviations are due to quantum effects (*e.g.*, H_2, He, Ne), to restriction of rotation, and to change in intramol. vibration on passing from vapour to liquid. The comparison of entropy of vaporisation at a const. gas to liquid vol. ratio is preferred to the Hildebrand method of comparison at const. mol. vol. (gas). An extension of the theory to metals is briefly considered. W. R. A.

Thermodynamic functions of a Fermi–Dirac gas. E. C. STONER (Phil. Mag., 1939, [vii], **28**, 257—286).—Mathematical. Expressions are obtained for the thermodynamical functions intrinsic energy E, total heat H, Helmholtz free energy F, Gibbs free energy G, and entropy S in terms of the basic Fermi-Dirac integrals, which have been evaluated previously. Suitable reduced forms of these functions are unique functions of a reduced temp. $\tau = kT/\varepsilon_0$, where ε_0 is the Fermi zero energy. Numerical tables are given for the reduced forms of E, F, G, and S for the range $0·0 \leqslant \tau \leqslant 2·0$. The way in which E, F, G, and S vary with temp. is shown graphically. T. H. G.

Thermodynamics of the thermomechanical effect of liquid He II. H. LONDON (Proc. Roy Soc., 1939, A, **171**, 484—496; cf. A., 1938, I, 609).—A thermodynamic investigation of the pressure difference between two vessels connected by a capillary and containing liquid He II at different temp. is given. Reversible thermal effects, analogous to the Peltier effect, must appear; cold is produced where He II

leaves a capillary and heat where it enters. A possible mechanism of heat transport as a result of circulation due to thermomechanical pressure is discussed.   G. D. P.

Properties of flow of liquid helium II. J. F. ALLEN and A. D. MISENER (Proc. Roy. Soc., 1939, A, 172, 467—491; cf. A., 1938, I, 610).—The dependence of the velocity of flow on pressure has been studied for capillary tubes of various diameters and lengths at temp. from the λ point to 1·15° K. The flow through a fine powder was also investigated. Classical hydrodynamical flow was observed only in the shortest capillary, essentially an orifice, and in the powder. The results are interpreted as indicating that two types of flow are operative: one a surface flow along the walls of the capillary, the other a viscous flow.   G. D. P.

Effect of an electric field on the viscosity of liquids. (A) S. SOSSINSKI. (B) E. N. DA C. ANDRADE and C. DODD (Nature, 1939, 144, 117, 117—118).—
(A) Attention is directed to the author's previous work (A., 1937, I, 125).
(B) A reply to the above, and a criticism of the view that the effect is due to hydrodynamic convection. Experiments additional to those reported previously (A., 1939, I, 191) indicate that the effect is due to the building up of comparatively rigid ionic layers on the opposite walls of the channel; the layers reach a limiting thickness at high fields.   L. S. T.

Viscosity and molecular diameter of azomethane. H. HENKIN and H. A. TAYLOR (J. Chem. Physics, 1939, 7, 829—830).—Measurements of rate of flow of azomethane (I), interpreted by Poiseuille's law, give $\eta^{23} = 0.754 \times 10^{-4}$ poise. Using the Sutherland const. for Δ^β-butylene, the mol. diameter of (I) is 4·54 A.   W. R. A.

Transport phenomena in the cage model of liquids. R. SIMHA (J. Chem. Physics, 1939, 7, 857).—Errata (cf. A., 1939, I, 249).   W. R. A.

Natural convection in liquids. O. A. SAUNDERS (Proc. Roy. Soc., 1939, A, 172, 55—71).—Approx. solutions are obtained to the problem of the natural convection set up in a fluid near the surface of a hot vertical plate. The theory gives vals. for the temp. and velocity gradients, and hence for the heat transfer and friction drag at the plate. Experiments were carried out to test the theory by measuring the loss of heat from a vertical plate in H_2O and Hg. Observations of the type of flow near the plate were also made by an optical method.   G. D. P.

Relations between massivity effects in salts and certain ionic and atomic characteristics. F. VLÈS and (MLLE.) M. GEX (Compt. rend., 1939, 209, 377—379).—" Massivity vals.," p_M (cf. Arch. Phys. Biol., 1928, VI, 3, 141), for a no. of cations in solutions of their chlorides have been redetermined colorimetrically, using sulphonecyanine 5*R* as indicator; the results are expressed by $p_M - 1.42 \log Z_{\text{eff}} = 4.70 v^{\frac{1}{2}} - 4.38$ ($Z_{\text{eff}} =$ Born–Heisenberg effective nuclear charge; $v =$ valency of ion). The data are correlated with the polarisability of the ions. Z_{eff} vals. obtained colorimetrically, using the

above equation, may be used to determine various ionic consts.   A. J. E. W.

Existence of hydrates of definite chemical composition in liquid phases. I. B. V. BAK (J. Phys. Chem. Russ., 1939, 13, 534—540).—The sp. conductivity, κ, and η of aq. $Na_2S_2O_3$ and $Ca(NO_3)_2$ at concns., c, up to 80% have been measured. The κ isotherms exhibit min. corresponding with $Na_2S_2O_3,5H_2O$ (I), $Ca(NO_3)_2,4H_2O$ (II), and $Ca(NO_3)_2,3H_2O$ (III), and max. on the c–temp. coeff. of κ curve occur at the same points; the form of the equiv. conductivity–c curves is anomalous. Whilst the η–c curves exhibit no singular points, the temp. coeff. of η–c curves have sharp max. corresponding with (I) and (III). (III) seems to be more stable in solution than (II).   R. C.

Origin of colour of paramagnetic ions in solution. II. Fine structure of the absorption bands. D. M. BOSE and P. C. MUKHERJI (Indian J. Physics, 1939, 13, 219—230).—The doublet structure of the absorption bands of paramagnetic ions in solution (cf. A., 1939, I, 16) is attributed to the presence of a superposed field of trigonal symmetry around the paramagnetic ions, due to the directed positions of the anions with respect to the cations in the solution. The splitting is of the order of magnitude calc. by Van Vleck for the D- and F-ions due to a trigonal field present in the alums containing these ions.   W. R. A.

Some properties of the dioxan–ethyl alcohol system. R. N. HOPKINS, E. S. YERGER, and C. C. LYNCH (J. Amer. Chem. Soc., 1939, 61, 2460—2461). —d_4^{25}, n_D^{25}, η^{25}, and b.p. data are recorded for the system dioxan–EtOH. The η–composition curve shows a min. at ~50%. A min. boiling temp. of 78·13° was observed at 9·3% dioxan.   W. R. A.

Ultrasonic velocities in and adiabatic compressibilities of mixtures of acetic acid and water. A. W. SMITH and L. M. EWING (J. Chem. Physics, 1939, 7, 632).—Ultrasonic velocities v have been measured at a frequency of 7·4 megacycles per sec. in various AcOH–H_2O mixtures at 25°. At ~30% AcOH v is max. and the adiabatic compressibility β, calc. from $v = (1/\rho\beta)^{\frac{1}{2}}$, is least.   W. R. A.

Pressure–volume–temperature relations in solutions. II. Energy–volume coefficients of aniline, nitrobenzene, bromobenzene, and chlorobenzene. R. E. GIBSON and O. H. LOEFFLER (J. Amer. Chem. Soc., 1939, 61, 2515—2522).—A table has been compiled of the vols. of NH_2Ph, $PhNO_2$, PhCl, and PhBr at temp. between 25° and 85° and pressures 1 to 1000 bars from measurements of the sp. vol. at 25°, the thermal expansions, and the compressions. The coeffs. $(\partial P/\partial T)_v$ and $(\partial E/\partial V)_T$ decrease as the temp. increases at const. vol., owing to an increase in the repulsive internal pressure which follows from an increased randomness of distribution of the mols. in the liquids at higher temp. The quantity $(B + P)$ of the Tait equation for the compressibility is identical with the repulsive internal pressure; it increases with temp. at const. vol. When combined with the total internal pressure the attractive internal pressure is estimated. The

attractive pressure, computed in this way, depends only on the vol. A SiO_2 wt. dilatometer for the rapid and accurate measurement of thermal expansion of solutions is described.　W. R. A.

Properties of dipicrylaminates. J. KIELLAND (J. Amer. Chem. Soc., 1939, **61**, 2285—2289).— Dipicrylaminate solutions are strongly coloured, yellow at high dilutions, and orange to red at intermediate and high concns. Chromatic analysis data, derived from extinction curves at different concns., are recorded. Solid dipicrylamine is yellow to orange according to purity and particle size, and the solid salts are red. From measurement of the d of aq. solutions at 18°, the mol. vol. of Na dipicrylaminate (I) has been computed. Activity coeff. data, derived from the measured f.p. depressions of H_2O by (I) (5×10^{-3} to 5×10^{-2}N.), suggest the strong association of anions. This is confirmed by the large conductivity at 0° of aq. (I) at intermediate concns. At 0·025N., however, an inflexion in the conductivity curve occurs, possibly caused by interaction between the associated anions and the cations. The heat of dissolution of aq. (I) at 0·005 and 0·01N. and the heat of dilution of a 0·125N. solution have been measured at 20°. Preliminary data are recorded on the partial miscibility in mixtures of dipicrylamine with aq. $CaCl_2$.　W. R. A.

Viscosity of ternary systems forming Martin slags. System FeO–CaO–SiO2. P. P. KOZAKE-VITSCH, S. P. LEIBA, and E. P. KOMAR (J. Phys. Chem. Russ., 1939, **13**, 248—258).—Vals. are recorded for η between 1200° and 1450°. The η of systems containing much CaO is almost independent of temp. as long as the system is homogeneous. The η of systems containing much SiO_2 decreases when the temp. rises. A small max. of η indicates the compound Fe_2SiO_4.　J. J. B.

Critical behaviour of solid solutions in the order–disorder transformation. H. A. BETHE and J. G. KIRKWOOD (J. Chem. Physics, 1939, **7**, 578—582).—Mathematical. A discussion of crit. phenomena in the order–disorder transformation from the viewpoint of the theories of Bethe (A., 1935, 1193) and Kirkwood (A., 1938, I, 188). The best vals. of the transition temp. and heat capacity anomalies ΔC_v of simple cubic and body-centred cubic lattices are given. The anomalies occurring at the crit. temp. (Eisenschitz, A., 1939, I, 133) are discussed with particular reference to the effects of anomalies in the coeffs. of expansion and compressibility on ΔC_p.　W. R. A.

Diffusion processes in binary crystalline systems. B. G. PETRENKO and B. E. RUBINSTEIN (J. Phys. Chem. Russ., 1939, **13**, 508—513).— Diffusion coeffs. and their temp. coeffs. (energies of loosening, Q) in α- and β-phases of the systems Ag–Zn, Ag–Cd, and Cu–Zn have been determined by observing the rate at which the volatile component evaporates from the alloy. For β-phases Q is ≪ for α-phases of the system. The results show that in intermetallic phases Q depends on the m.p. of the phase and is $\propto$ (radius of diffusing atom)^2 (cf. A., 1937, I, 296).　R. C.

Magnetic properties of copper amalgams. S. S. BHATNAGAR, P. L. KAPUR, and G. MITTAL (Proc. Indian Acad. Sci., 1939, **10**, A, 45—54).—A detailed account of work already noted (A., 1939, I, 138).　W. R. A.

X-Ray emission spectra and electronic structure of Al–Cu and Al–Ni alloys. J. FARINEAU (J. Phys. Radium, 1939, [vii], **10**, 327—332).—The influence of composition on the intensity distribution in the X-ray emission bands of Al–Cu and Al–Ni alloys, due to the exterior electrons of Al atoms ($K\beta_x$ ray) and Cu and Ni atoms ($L\alpha$ ray), has been studied experimentally, and the data are discussed with reference to the physical characteristics of these alloys and the quantum theory of metals; they also furnish indications of the electronic structure of the alloys.　W. R. A.

[Crystal structure of] the alloy MnBi. R. HOCART and C. GUILLAUD (Compt. rend., 1939, **209**, 443).—The alloy has a NiAs structure, a_0 4·30, c_0 6·12 A.; the rhombic unit cell contains 2 Mn at (0, 0, 0) and (0, 0, $\frac{1}{2}$), and 2 Bi at ($\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{4}$) and ($\frac{2}{3}$, $\frac{1}{3}$, $\frac{3}{4}$). The shortest Mn—Mn and Mn—Bi distances are 3·06 and 2·92 A., respectively.　A. J. E. W.

Electrical resistance of ferromagnetic amalgams. L. F. BATES and W. P. FLETCHER (Proc. Physical Soc., 1939, **51**, 778—783; cf. A., 1937, I, 559; 1939, I, 309).—Investigations with Co amalgams containing 0·149—0·548 g. Co per 100 g. Hg over the temp. range 20—340° gave temp.-resistance curves varying in type with concn. of the amalgam, but each showing, for initial heating, a sharp change in resistivity at ~340° from a val. < that of pure Hg to a val. considerably greater. The transition temp. was lowered on subsequent heating. Similar changes were observed with Fe amalgams of concn. 0·243—0·497%.　N. M. B.

Crystal structure of TiCo2. H. J. WALLBRUM and H. WITTE (Z. Metallk., 1939, **31**, 185—187).— Two forms exist : α, stable at high temp. and over a narrow range at room temp. in the presence of a small excess of Ti, has a Cu_2Mg structure with a 6·691 A., 8 mols. per unit cell, d 7·25, whilst β, stable over a wider composition range towards the Co side, has a hexagonal Ni_2Mg structure with a 4·715, c 15·37 A., 8 mols. per unit cell, d 7·47.　A. R. P.

Detection of superstructure phases in the nickel–iron system. A. KUSSMANN (Z. Metallk., 1939, **31**, 212—214).—From a crit. review of recent work it is concluded that there is not yet sufficient evidence for the existence of Ni_3Fe.　A. R. P.

System cadmium–tin–thallium. E. JÄNECKE (Z. Metallk., 1939, **31**, 170—171).—Cd, Sn, and Tl form a simple eutectiferous system with a ternary eutectic formed by merging of the three binary eutectics at 129·5°, Cd 19, Sn, 42, Tl 39%. The heat effect at 129° in the Sn–Cd system is shown by ternary alloys which deposit Sn or Cd as primary and Cd or Sn as secondary crystallites; the presence of Tl decreases the temp. at which it occurs to 111—114°.　A. R. P.

Ternary systems of aluminium. II. Aluminium–iron–manganese and aluminium–copper–

manganese. H. HANEMANN and A. SCHRADER (Z. Metallk., 1939, **31**, 183—185).—The systems were studied by thermal analysis and micrographic examination. Al, FeAl₃, and MnAl₆ form a ternary eutectic at 654·1°, Fe 1·8, Mn 0·7%. MnAl₆ has a wide solid solution range, and no ternary compound exists between the Al corner and the FeAl₃–MnAl₆ line. Al, Cu, and Mn form two ternary phases with rhombic structures : T with a 7·69, b 24·06, c 12·48 A. contains Cu 19 and Mn 24%, and Y with a 14·79, b 12·60, c 12·43 A. contains Cu 5·9 and Mn 32·5%. There is a ternary eutectic at 547·3°, Cu 31·5, Mn 0·8% between CuAl₂, T, and Al-rich solid solution, and three peritectic reactions, that due to liquid + MnAl₆ $\rightleftharpoons$ α + T occurring at 628·5°. A. R. P.

Solubilities of components of gas mixtures in liquids under pressure. J. D. ZELVENSKI (J. Phys. Chem. Russ., 1939, **13**, 514—527).—A thermodynamical relation for the solubilities in a non-volatile solvent has been derived, in which allowance is made for interaction between the solutes. The solubilities in H₂O at 25° of N₂, H₂, and CO₂ from mixtures of N₂ + CO₂ and H₂ + CO₂ under 50—300 atm. have been determined, and agree with this relation. CO₂ reduces the solubility of N₂ and H₂ by as much as 20%, whilst the solubility of CO₂ is depressed by the presence of N₂ or H₂. These interactions represent a max. energy effect of 110—125 g.-cal. per mol. From the above data the fugacity of CO₂ in admixture with N₂ and also with H₂ up to 300 atm. at 25° has been calc. R. C.

Solubility of silicon tetrafluoride in organic solvents. Behaviour of such solutions. G. TARBUTTON, E. P. EGAN, jun., and S. G. FRARY (J. Amer. Chem. Soc., 1939, **61**, 2555—2556).—Saturated solutions of SiF₄ in various org. solvents have been prepared. The rate of dissolution of the gas appears to depend largely on the fluidity of the solvent. The solubility in the homologous series of monohydric alcohols decreases regularly with increase in the no. of C. For alcohols containing the same no. of C the solubility decreases as the no. of OH increases. Compounds containing ether (diethylene glycol), CO (COMe₂ and AcCO₂H), and CO₂H groups (AcOH and AcCO₂H) are not good solvents. SiF₄ is sparingly sol. in C₆H₆ and C₂HCl₃, and insol. in CCl₄. Addition of 9 wt.-% H₂O to the saturated SiF₄ solution in 95% EtOH gave a gelatinous ppt. of hydrated SiO₂. Distillation of the same solution in a vac. at room temp. caused liberation of SiF₄ until a solution containing ~26·5% SiF₄ remained. Addition of an equal vol. of H₂O to this solution gave no ppt., possibly owing to chemical interaction between the SiF₄ and EtOH. Subsequent addition of a sol. Ba salt pptd. 95% of the F′ ion as pure BaSiF₆, providing a convenient method for the formation of this compound. W. R. A.

Permeability of metal membranes to diatomic gases. R. M. BARRER (Phil. Mag., 1939, [vii], **28**, 353—358).—Wang (A., 1937, I, 75) has shown that at infinite pressure p the rate P of permeation of a metal plate may be infinite. This is in error owing to the use of incomplete rate equations for some of his assumed phase boundary processes. By using completed equations for Wang's processes it is shown that P is always finite. It is also shown that whatever the phase boundary processes P must be finite. The observed linear relation between P and $p^{\frac{1}{2}}$ can be shown to be due to the very great concn. discontinuities which may occur at the boundaries of the plate, particularly in systems which are not in equilibrium. T. H. G.

Demixing phenomena in hydrocarbons. A. SCHAAFSMA (Nederl. Tijds. Natuurkunde, 1936, **3**, 215—217; Chem. Zentr., 1937, i, 2347).—Miscibility in binary hydrocarbon systems, and its dependence on temp., mol. wt., and the chemical nature of the components, are discussed. A. J. E. W.

Necessity for assuming a chemical affinity between solvent and solute. O. SCARPA (R.C. Atti Accad. Lincei, 1939, [vi], **29**, 247—253).—The distribution of a solute between two immiscible solvents is discussed theoretically. It is necessary to assume the existence of chemical interaction between solute and solvent even in dil. solution. O. J. W.

Application of statistical methods to immobile adsorbed films. J. K. ROBERTS and A. R. MILLER (Proc. Camb. Phil. Soc., 1939, **35**, 293—297).—The rate of condensation of diat. mols. which are adsorbed with dissociation to form an immobile film, the two atoms of one adsorbed mol. occupying neighbouring sites, is determined statistically by Bethe's method. A lower limit to the isolated unoccupied sites is obtained. F. J. L.

Activated adsorption of nitrogen on iron at 23° and 100°, and ammonia synthesis. O. BEECK and A. WHEELER (J. Chem. Physics, 1939, **7**, 631—632).—Rapid chemisorption of H₂ takes place at room temp. on both Ni and Fe films, but, in contrast to Ni, Fe also adsorbs N₂. The adsorption of N₂ : H₂ is 1 : 5. Adsorption of H₂ on Fe is almost instantaneous, but that of N₂ slow. Fe holding adsorbed N₂ takes up H₂ until the total no. of adsorbed mols. is the same as for H₂ alone, no interaction occurring between the co-adsorbed gases. An Fe film heated to 100° and then allowed to cool to room temp. will take up ~80% of the H₂ of a film evaporated at room temp. Such a film uses $\leqslant$ 0·2 of the available surface in N₂ adsorption, whilst the film adsorbs at 100° as much N₂ as the film evaporated at room temp. The adsorption is much faster on the sintered catalyst. Fe films on which N₂ is actively adsorbed at room temp. or at 100° liberate NH₃ when dissolved in HCl, and the amount of NH₃ agrees approx. with the N₂ adsorbed. The NH₃ synthesis is independent of the presence of adsorbed H₂. N₂ is not adsorbed at either temp. if H₂ is admitted to the Fe film first. NH₃ is not produced in the gas phase by heating Fe, on which N₂ is adsorbed, in an atm. of H₂. W. R. A.

Calculations of adsorption behaviour of argon on alkali halide crystals. W. J. C. ORR (Trans. Faraday Soc., 1939, **35**, 1247—1265).—Heats of adsorption of A and equilibrium distances of the adsorbed atom at various positions on the surface of crystals of KCl and CsI, and the variation in the heat of adsorption in passing from the first to the second adsorbed layer, are calc. F. L. U.

Sorption of gases and vapours by titania gel. VI. Sorption and desorption equilibria of organic vapours and critical limit of capillary condensation phenomena. I. HIGUTI (Bull. Inst. Phys. Chem. Res. Japan, 1939, **18**, 657—684).— Sorption and desorption isotherms at 0°, 10°, and 20° for CCl_4, $CHCl_3$, CH_2Cl_2, CS_2, Me_2O, and C_6H_6, on TiO_2 gel, have been obtained. Hysteresis is exhibited at higher pressures, but at low pressures reversible equilibrium occurs. The results are discussed in the light of the capillary theory, and it is shown that at saturation or for any given pore radius, the amount of vapour sorbed expressed as vol. of liquid is almost the same for all of the vapours and independent of temp.; that the plot of log p against log a is a straight line with a break where capillary condensation occurs; and that with increasing amount sorbed the differential heat of sorption approaches a const. val. which is $\sim$ the heat of condensation. From the results the vals. of the ratio (min. capillary radius for meniscus formation) : (mol. radius) are calc. to be $\sim$ the theoretical val. (= 4).   F. J. G.

Effect of surface oxides on the sorptive properties of activated charcoal towards vapours. E. ZAVERINA and M. DUBININ (J. Phys. Chem. Russ., 1939, **13**, 151—162).—Charcoal (I) activated by CO_2 or by heating in vac. at 950° adsorbs less NaOH and more HCl, H_2SO_4, HCO_2H, or AcOH than charcoal (II) activated by air at 350° or 500°. The sorption of methylene-blue, PhOH, or $BuCO_2H$ from H_2O is identical for (I) and (II). Vapours of C_6H_6, C_5H_{12}, or C_7H_{16} are sorbed by (I) more strongly than by (II), whilst the sorptions of MeOH are identical. An electrostatic explanation of this behaviour is advanced.   J. J. B.

Velocity of adsorption on charcoal. E. ANGELESCU and E. SOLOVIU (Bul. Soc. Chim. România, 1938, **20**, 197—223).—Previous work is reviewed and discussed. Measurements have been made of the rate of adsorption on two varieties of active C of $H_2C_2O_4$ (I), AcOH, $EtCO_2H$, and Pr^nCO_2H, and of mixtures of (I) with each of the others, from aq. solutions of varied concn., over an interval of 60 min. None of the formulæ hitherto proposed is valid over the whole interval. The results are best explained by assuming adsorption to consist of two consecutive processes, the first rapid, the second much slower. If measurements are started 5 min. after bringing the solution into contact with C, the slow process is shown to conform to the equation for a unimol. reaction. The velocity of the initial process increases with the concn., and with the capillary activity of the solute. In mixed solutions, if one solute increases the amount of the other adsorbed at equilibrium, it also increases its initial velocity of adsorption, and vice versa.   F. L. U.

Adsorption of ions on polar adsorbents in relation to the reaction [p_H] of the medium. II. Adsorption from mixtures of multivalent anions on ferric hydroxide in relation to alkali concentration. III. Discussion and interpretation of results. G. BĂLĂNESCU and V. T. IONESCU (Bul. Soc. Chim. România, 1938, **20**, 139—183, 185—195; cf. A., 1938, I, 510).—II. The effect of varying the p_H and the relative amounts of two adsorbable anions present in solution on the adsorption of each by $Fe(OH)_3$ has been investigated for the following pairs : phosphate–arsenate, phosphate–citrate, phosphate–sulphate, arsenate–sulphate, phosphate–oxalate, arsenate–oxalate, and oxalate–citrate. The results are tabulated.

III. The apparent agreement of the results with the valency rule vanishes when the p_H is taken into account; e.g., in acid solution phosphate and arsenate ions are more strongly adsorbed than are sulphate and oxalate, although under these conditions the former are univalent; in neutral solution, in which they are bivalent, they are more strongly adsorbed than is the tervalent citrate ion. In an alkaline medium the behaviour is determined by the distribution of the anions between the two bases $Fe(OH)_3$ and NH_4OH or KOH. The anions are displaced from the adsorbent by OH' in the order $SO_4'' > C_2O_4'' >$ citrate''' $> AsO_4''' > PO_4'''$. The conditions under which $Fe(OH)_3$ can be peptised by added anions are discussed.   F. L. U.

Exchange adsorption by colloidal titanium dioxide. V. KARGIN and M. TOLSTAJA (J. Phys. Chem. Russ., 1939, **13**, 211—215).—In the course of coagulation of TiO_2 by Na_2SO_4–H_2SO_4 mixtures the adsorption of SO_4'' decreases almost linearly as p_H increases. The adsorption of Cl' is immeasurably small.   J. J. B.

Surface reactions. II. Effect of solutions of neutral salts on ash-free charcoal. L. LEPIN and G. STRACHOVA (J. Phys. Chem. Russ., 1939, **13**, 216—223).—If charcoal is kept in a solution of KCl or $BaCl_2$ the concn. of which is gradually raised and then lowered, the amount of Cl adsorbed increases since the acidity of the solution changes. Only when the acidity changes are eliminated is a reversible adsorption isotherm obtained.   J. J. B.

Photoactivation of crystals and its influence on adsorption processes. G. COHN, J. A. HEDVALL and (in part) A. ASSARSSON and S. BERGER (Svensk Kem. Tidskr., 1939, **51**, 163—173).—The change in the adsorptive power of CdS for dyes on illumination with polychromatic light of $\lambda > 370$ mμ. has been studied. Xanthene, $CHPh_3$, azine, thiazine, azo-, and alizarin dyes, and phenolphthalein, give erratic results, ranging from 54% increase in adsorption to 85% decrease. Vals. are roughly reproducible for any one substance, but no correlation with structure of the adsorband can be found.   M. H. M. A.

Adsorption of calcium and aluminium soaps of hydroxycarboxylic acids on asbestos surface. Z. V. VOLKOVA and A. V. ZAPOROSHETZ (Min. Suire, 1936, **11**, No. 4, 69—73).—Micelles of the solutions of Al soaps have a more complex structure and are more highly solvated than those of Ca soaps. Al soaps are more strongly adsorbed on asbestos (I) surfaces than are Ca soaps, although in presence of moisture adsorption of either is much reduced. Al soaps stabilise moist (I) better than do Ca soaps, and differ from the latter in that their films on (I) cannot be removed with non-polar solvents. Al soaps bind

the (I) particles more firmly in a dried paint film than do Ca soaps, but drying is slower.

CH. ABS. (e)

Polarographic examination of the adsorption of cations by proteins. G. CARRIÈRE (Chem. Week-blad, 1939, **36**, 612—613).—Ba⁺⁺ is adsorbed readily by gelatin sols in presence of LiCl or in absence of an indifferent electrolyte, but not in presence of NEt_4I. Ba⁺⁺ is absorbed from solutions of NEt_4I by suspensions of potato starch or of sol. starch but not by colloidal solutions.
S. C.

Sorption of methylene-blue by curd fibres of sodium palmitate. J. W. McBAIN, (MISS) J. M. McDOWELL, and (MISS) M. E. WORDEN (J. Amer. Chem. Soc., 1939, **61**, 2540—2544).—Curd fibres of Na palmitate adsorb methylene-blue to approx. the same extent whether the dye is added to fibres already formed or the fibres are formed *in situ* in presence of the dye. In either case time is required to complete the sorption, indicating that the latter must take place on the surface of the primary ultra-microscopic cryst. fibres. After a week the wt. and no. of dye mols. sorbed are > those of Na palmitate mols.; thereafter the sorption decreases, and after a year may be only 1/3. The solubility of curd fibres formed from conc. solutions is only slightly > that of those from dil. solutions, but both diminish to about the same extent with time. The stronger curds are much more alkaline than any soap solution. W. R. A.

Interfacial tension studies on mercury in reacting systems. N. V. R. IYENGAR and B. S. RAO (Proc. Indian Acad. Sci., 1939, **10**, A, 20—30).—A method for controlling the rate of formation of drops in the drop-wt. method of determining surface and interfacial tensions with Hg as one phase is described. The interfacial tension of Hg has been measured in the following solutions : H_2S, SO_2, $H_2S + SO_2$, and S in CCl_4; KI, KCN, K_2HgI_4, and $K_2Hg(CN)_4$ in H_2O. The results are discussed. W. R. A.

Wettability of solids as a characteristic property of the molecular nature of their surfaces. A new method for its measurement. Z. V. VOLKOVA (J. Phys. Chem. Russ., 1939, **13**, 224—238).—The contact angle θ of drops of H_2O on talc was measured directly and calc. from the dimensions of the drop. On a fresh surface θ was ~80°, and in 2 days decreased to 15°. This alteration of θ is interconnected with the passage of Mg⁺⁺ from talc into H_2O, which was also measured. J. J. B.

Correspondence between changes of state in two and in three dimensions. D. DERVICHIAN (J. Phys. Radium, 1939, [vii], **10**, 333—349).—Unimol. layers of a substance reproduce in detail the usual physical states of the substance in bulk with the successive production of solid, liquid, meso-morphic state, gas. In the solid state there is true correspondence between the cryst. forms. A theory of liquid layers is developed in which the vaporisation point of the film is analogous to a layer of mols. retained in the midst of the isotropic liquid, and the saturation point to the free surface of the liquid. The ideas of crit. temp. of liquefaction and of crystallisation, and of the triple point, are introduced for

surface layers. Different types of films are classified, and the passage from one type of film to another is considered. W. R. A.

Higher-order transformation in unimolecular layers. D. DERVICHIAN and M. JOLY (J. Phys. Radium, 1939, [vii], **10**, 375—384).—A detailed account of work already noted (A., 1939, I, 367). W. R. A.

Anomalous properties of thin multimolecular films. V. Experimental investigation of multi-molecular solvate (adsorbed) films as applied to the development of a mathematical theory of the stability of colloids. B. DERJAGUIN and M. KUSSAKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 25—44).—An improved method of measuring the thickness of films of liquid between a solid surface wetted by them and a gas bubble is described (cf. A., 1937, I, 358; 1938, I, 194). The importance of such films for the conception of solvation and for the theory of colloid stability is discussed. F. L. U.

Mechanical properties of unimolecular layers (films) in liquid–liquid interfaces. P. F. POCHIL (J. Phys. Chem. Russ., 1939, **13**, 301).—The rigidity of myristic and palmitic acid films in the H_2O–kerosene interface was determined. J. J. B.

Structure of protein films. E. G. COCKBAIN and J. H. SCHULMAN (Trans. Faraday Soc., 1939, **35**, 1266—1276).—F–A and V–A relations (F = surface pressure, V = surface potential, A = area per mg.) have been determined for films of gliadin (I) on aq. substrates of p_H 2·0 and 7·2. A region of high compressibility between $A = 1·6$ and $1·0$ sq. m. per mg. corresponds with the elimination of H_2O from inter- and intra-micellar spaces; the vertical component of the mean electric moment per (I) residue remains const. during this compression, indicating that no re-orientation of the mols. occurs. Tannic acid (II) present in the substrate converts micelles of (I) in expanded films into gelatinous units, whereas at higher compressions (>4 dynes per cm.) there is decreased interaction between (I) and (II); it is inferred from this that in this region re-orientation of the mols. occurs in such a way as to make the basic side-chains less accessible. Stereochemical considerations are advanced to support the view that a separation of polar and non-polar side-chains at the interface takes place by looping of the polypeptide chains. It is held that protein films cannot consist of fully extended polypeptide chains of the β-keratin type or of any other regular polypeptide pattern. F. L. U.

New method of absorbing aërosols and gases by liquids. G. P. LUTSCHINSKI (J. Phys. Chem. Russ., 1939, **13**, 302).—Smokes, mists, and gases like NO which are not absorbed by ordinary liquids are taken up by foams or foaming liquids. J. J. B.

Distribution of charge and potential in an electrolyte bounded by two plane infinite parallel plates. A. J. CORKILL and L. ROSENHEAD (Proc. Roy. Soc., 1939, **A, 172**, 410—431).—An exact solution of the problem is obtained. The theoretical results are compared with experimental data on the stratification of certain colloidal oxides which tend

to separate into horizontal layers at the bottom of the vessels which contain them (Zocher stratification).
G. D. P.

Oligochemical factors which influence the formation of gold sols by Zsigmondy's method. R. WERNICKE (Anal. Asoc. Quím. Argentina, 1939, **27**, 74—79).—Oxidising or reducing salts such as Na_2S, $Na_2S_2O_3$, KCNS, $KMnO_4$, $K_4Fe(CN)_6$, $K_3Fe(CN)_6$, K_2CrO_4, and $K_2Cr_2O_7$ favour or impede the formation of colloidal centres in the reduction of Au salts by CH_2O owing to direct intervention in the reaction, not to catalysis. $10^{-6}N$-KCN impedes Au sol formation owing to its solvent action for Au in presence of O_2.
F. R. G.

Effect of contact with the atmosphere on the properties of water employed in the preparation of gold sols by Zsigmondy's method. R. WERNICKE and J. MENDIVE (Anal. Asoc. Quim. Argentina, 1939, **27**, 80—89).—Formation of Au sols by the action of CH_2O on alkaline $HAuCl_4$ is initiated only in redistilled H_2O which contains reducing substances or has a free surface exposed to the air.
F. R. G.

Purified palladium sols prepared by electric sparking. W. PAULI, W. HOFF, and F. LICHTEN-STERN (J. Amer. Chem. Soc., 1939, **61**, 2295—2299).—The prep. of Pd sols by sparking under conductivity H_2O, and $10^{-3}N$-H_2SO_4, -NaOH, -HNO_3, -KCl, and -HCl are given and discussed briefly. When chlorides are used the charging group of the sols is probably the chlorohydroxo mixed complex of varying composition, which maintains a decomp. equilibrium with mol. disperse $PdCl_2$.
W. R. A.

Importance of polarographic methods of investigation for colloid chemistry. J. A. W. VAN LAAR (Chem. Weekblad, 1939, **36**, 611—612).—The importance of the extreme freedom from heavy metals of H_2O in the prep. of sols, e.g., of AgI, is stressed. H_2O doubly distilled in tinned or Ag apparatus heated in an electric oven contains $10^{-9}N$-Cu and $10^{-8}N$-Zn.
S. C.

Chemistry of colloid–colloid reactions. VII. Highly purified protected Sb_2S_3 sols. W. PAULI and H. ZENTNER (Trans. Faraday Soc., 1939, **35**, 1234—1239; cf. A., 1938, I, 138).—Mixed Sb_2S_3 and dextrin sols, when purified by electrodecantation, give a sol in which the Sb_2S_3 particles are partly covered with dextrin, none of the latter remaining in the intermicellar liquid. The surface of the particles has the same electrochemical constitution as in the absence of dextrin, but the charge is reduced to a half, and the sol is partly protected against coagulation by KCl. The reduction of the charge is due to the partial screening of ionogenic groups by adsorbed dextrin.
F. L. U.

Aqueous rubber dispersions.—See B., 1939, 1058.

Solubility of high-molecular compounds. V. V. KARGIN, S. PAPKOV, and Z. ROGOVIN (J. Phys. Chem. Russ., 1939, **13**, 206—210).—Solutions of high-mol. compounds differ from colloidal solutions as the phase rule is applicable to them. The validity of the phase rule may be obscured by a slow attain-

ment of equilibrium and by the polydispersity of the solutions.
J. J. B.

Electrolytes and the viscosity of pectin solutions. H. P. KORTSCHAK (J. Amer. Chem. Soc., 1939, **61**, 2313—2317).—The influence of added electrolyte [NaOH, $Ca(OH)_2$, KOH, NaCl, HCl, $CaCl_2$, $KClO_4$, aconitic acid] on the η of 1% pectin sols has been studied at $27\cdot5°$. At low electrolyte concn. η increases if the electrolyte is alkaline, owing to the formation of the more highly ionised pectin salt. At intermediate concns. η falls to a min. and remains const. over a considerable concn. range. This suggests the formation of almost uncharged, undissociated pectin salts, causing dehydration and decreased η. At high salt concn. η increases through the interaction of the added electrolyte with H_2O, and the increased pectin concn. with respect to H_2O alone. The η of pectin solutions varies similarly to that of many truly sol. electrolytes with respect to added electrolyte, and the colloidal character of the solutions is not therefore a determining factor.
W. R. A.

Transition of hydrate cellulose into native cellulose.—See B., 1939, 1028.

Surface structure of gels. I. Heat of wetting of silicic acid gels. G. RICHLIKOV and B. BRUNS (J. Phys. Chem. Russ., 1939, **13**, 502—507).—The differential heats of wetting by H_2O of and the isotherms for the adsorption of H_2O vapour on SiO_2 preps. have been measured. In some preps. there seem to be two adsorbing regions differing in adsorption potential.
R. C.

Gelation of bromophenol-blue. E. S. AMIS and V. K. LaMER (Science, 1939, **90**, 90—91).—Bromophenol-blue (I) appears to be exceptional in forming a gel after acidification of a faded solution of the dye in dil. alkali (cf. A., 1939, I, 327). Phenolphthalein does not gel after similar treatment. The time of gelation of (I) depends on its initial concn. The mechanism of gel formation is discussed.
L. S. T.

Isoelectric point of collagen. J. H. HIGHBERGER (J. Amer. Chem. Soc., 1939, **61**, 2302—2303).—Collagen, prepared from steer hide with the min. of alkaline treatment, has isoelectric point p_H $7\cdot8$ (measured by electrophoretic mobility) in buffers of ionic strength $0\cdot005$. The previously determined point, p_H $4\cdot7$, is due to degradation by alkali during prep.
R. S. C.

Coagulation of hydrophobic sols with mixed electrolytes. I. Coagulation of negative silver iodide sol with a mixture of salts of potassium and multivalent metals. II. Method of evaluating ion antagonism in coagulation. L. LEPIN and A. BROMBERG (Acta Physicochim. U.R.S.S., 1939, **10**, 83—101, 102—120; cf. A., 1939, I, 469).—I. The coagulating effect of mixtures of K salts is approx. additive, irrespective of the valency of the anion; in all mixtures of K salts with those of metals having a valency >1 ion antagonism, increasing with the valency of the second metal, is observed. With mixtures of salts having cations of equal valency (>1), the degree of antagonism is determined by the valency of the anion which is present in excess, when the two anions differ; when they are the same

(mixtures of sulphates) the effect depends on the nature of the cation. The effect in the former case is attributed to electrostatic interaction, and in the latter to a tendency to complex formation.

II. Ion antagonism is expressed as the ratio of the concn. of an electrolyte A actually needed to produce coagulation to the concn. which would be required if the effect were strictly additive, when A is present in a mixture with a fixed concn. of a second electrolyte. The experimental data indicate that ion antagonism is determined chiefly by interionic Coulomb forces, and with a const. concn. of a univalent coagulating cation, depends on the valency of the second cation and on the ionic strength of the solution. Relatively large positive deviations from additivity occur in mixtures containing ions which tend to form complexes; in this case the effect is due directly to reduction of the concn. of the coagulating ion. Ostwald's expression for the magnitude of ion antagonism (A., 1937, I, 515) is not supported by the authors' experiments.   F. L. U.

Electrophoresis of collagen. J. BECK, jun., and A. M. SOOKNE (J. Res. Nat. Bur. Stand., 1939, 23, 271—273).—The electrophoretic mobilities of limed hide, fresh hide, tendon, and bone collagens and of gelatin from hide collagen have been determined at 25° in 0·02M-AcOH, -HCl, -H_3PO_4, and -H_3BO_3 buffer solutions. The divergences in the mobilities at lower acidities are explained by differences in the NH_2-N contents of the preps. Liming changes the isoelectric point of hide collagen from $p_H \sim 7$ to $\sim 5·3$, whilst tendon and bone collagens have isoelectric point ~ 6 and the gelatin ~ 5. These differences are explained by the treatments used in their prep.   J. W. S.

Electrophoretic studies of silk. A. M. SOOKNE and M. HARRIS (J. Res. Nat. Bur. Stand., 1939, 23, 299—308).—The mobility of particles of raw silk in HCl–KCl and AcOH–NaOAc buffer solutions is identical with that of Pyrex glass particles coated with sericin (I), and hence is attributed to adsorbed (I). After removal of the (I) by repeated washing with soap, aq. NH_3, HCl, and EtOH, or by enzyme action, the residual fibroin (II) has a changed p_H–mobility curve. The isoelectric points vary with the total ionic strength and the nature of the buffer solution, but for AcOH–NaOH buffer solutions of total ionic strength 0·02 are at p_H 4·3 for (I) and 3·6 for (II). Since the mobility of (I) is $\gg$ that of (II) it has probably more active CO_2H and NH_2 groups. Consequently, for even dyeing, it is important to obtain uniform or complete removal of (I) during degumming. Dissolved (II) adsorbed on glass and (II) regenerated from the solutions have equal isoelectric points but different mobility–p_H curves, whereas (II) regenerated from solutions in LiBr give the same p_H–mobility curve as untreated (II).   J. W. S.

Partial pressure of hydrogen chloride from its solutions in ethylene glycol and other solvents at 25°. S. J. O'BRIEN, C. L. KENNY, and R. A. ZUERCHER (J. Amer. Chem. Soc., 1939, 61, 2504—2507).—The partial v.p. of HCl from its solutions in $(CH_2 \cdot OH)_2$ (1·33—8·78M.) has been measured at 25°, and data on the partial v.p. of HCl in C_6H_6

and $PhNO_2$ solutions at 25° are also recorded. The data are considered in terms of two different acid–base reactions, and a method of calculating the equilibrium consts. for these reactions is given. The importance of H-bonding and the nature of the solute in determining the basicity of the solvent is indicated.   W. R. A.

Polarimetric study of the influence of temperature on aqueous solutions of l-malic acid. R. DESCAMPS (Bull. Soc. chim. Belg., 1939, 48, 293—314; cf. A., 1939, II, 468).—The reaction l-malic acid $\rightleftharpoons H_2O$ + (active products of dehydration) is reversible, and the equilibrium is shifted to the right by rise of temp. The variation with time of $[\alpha]$ occurs even at room temp. in conc. solutions.   F. J. G.

Thermodynamic relation between dissociation pressure and solubility of complex strong electrolytes. I. G. RISS (J. Phys. Chem. Russ., 1939, 13, 547—550).—A relation has been derived permitting the relative thermal stabilities of a series of salts with a common dissociating complex ion to be calc. from the solubilities and activity coeffs. of the original salt and the product of its dissociation.   R. C.

Spectroscopic determination of association equilibria. H. KEMPTER and R. MECKE (Naturwiss., 1939, 27, 583—584).—The variation with concn. of the intensity of the association band of PhOH (λ 9900 A.) in CCl_4 solution has been determined. The absorption band at 9680 A. is to be ascribed only to the undissociated single mol. The association is bimol., and at great dilutions leads to $(PhOH)_2$. At higher concns. the reaction is $PhOH + (PhOH)_n = (PhOH)_{n+1}$. At room temp. $k = \alpha c/(1 - \alpha^{\frac{1}{2}})$, where c is concn., α is % association, and k is const.   A. J. M.

Polyiodides and polyiodide ions. Potassium polyiodides. G. VENTURELLO and N. AGLIARDI (Gazzetta, 1939, 69, 333—339).—d and η data for solutions of I + KI in H_2O–EtOH mixtures have been obtained at 20·5°. The results indicate the existence in solution of the compounds KI_3, KI_7, and KI_9 or of the corresponding ions I_3', I_7', and I_9'.   O. J. W.

Sodium polyarsenophosphates and the specific conductivity of their aqueous solutions. A. A. BOMBELLI (Anal. Asoc. Quím. Argentina, 1939, 27, 90—92).—Solutions of $Na_4As_2O_7$ with $NaPO_3$ in the mol. proportions 1 : 1—1 : 23 have a higher conductivity if the mixtures have been fused before dissolution. This is attributed to the formation of complex ions.   F. R. G.

Rate of ionisation in aqueous solution of the carbon–hydrogen bond in aliphatic compounds. K. F. BONHOEFFER, K. H. GEIB, and O. REITZ (J. Chem. Physics, 1939, 7, 664—670).—The rate of ionisation of the C·H bond to give protons has been studied by the exchange reactions between D_2O and $MeNO_2$, $COMe_2$, MeCHO, AcOH, MeCN, $MeSO_3H$, and halogenated and OH-compounds in the presence of a base catalyst, e.g., the OD' ion. The data are recorded in terms of the velocity coeff. of ionisation k at 25°. k ranges from 10^3 to 10^{-7}, and substituents

affect k in the order $NO_2 \gg CO \gg CN > CO \cdot NH_2 \gg CO_2' > SO_3' \gg Cl > OH > Me$. The possibility of studying the mechanism of ionisation of CH through kinetics rather than from the thermodynamical viewpoint is discussed. W. R. A.

Ionisation in non-aqueous solvents. II. Formation of certain ammines. W. L. GERMAN and R. A. JAMSETT (J.C.S., 1939, 1337—1341).—The reactions between NH_3 and $HgCl_2$, $CuCl_2$, $CoCl_2$, $NiCl_2$, $CaCl_2$, CdI_2, and $AgNO_3$, in EtOH and MeOH, have been studied conductometrically. The following ammino-salts are formed directly : $Ag(NH_3)_2NO_3$, $Cu(NH_3)_2Cl_2$, $Cu(NH_3)_3Cl_2$, $Co(NH_3)_2Cl_2$, $Cd(NH_3)_2I_2$, $Ca(NH_3)_2Cl_2$, $Ni(NH_3)Cl_2$, $Ni(NH_3)_2Cl_2$. In some instances they are pptd., or can be isolated by evaporation. $HgCl_2$ gives indefinite compounds. Λ for NH_3 alone in these solvents is very small. F. J. G.

Dissociation constants of selenious acid. H. HAGISAWA (Bull. Inst. Phys. Chem. Res. Japan, 1939, 18, 648—656).—Using the glass electrode the dissociation consts. were found to be $K_1 = 0.0024$ and $K_2 = 4.8 \times 10^{-9}$. F. J. G.

Properties of electrolytes in mixtures of water and organic solvents. II. Ionisation constant of water in 20, 45 and 70% dioxan–water mixtures. III. Ionisation constant of acetic acid in 82% dioxan–water mixture. H. S. HARNED and L. D. FALLON (J. Amer. Chem. Soc., 1939, 61, 2374—2377, 2377—2379).—The ionisation const. K of H_2O has been determined at 5° intervals from 0° to 50° in dioxan–H_2O mixtures (20, 45, and 70%) from measurements of the e.m.f. of the cells, $H_2|NaOH$ (m_1), NaCl (m_2), dioxan (X), H_2O $(Y)|AgCl$–Ag. The accuracy of measurement of K diminishes with increasing dioxan concn., owing to the change in relative solubility of AgCl and AgOH. This change cannot be avoided if Ag–AgCl electrodes are used, and the suitability of AgBr(I)–Ag electrodes is indicated. Heat content and heat capacity changes of the ionisation reaction have been evaluated.

III. From measurement of the e.m.f. of the cells, $H_2|AcOH$ (m_1), NaOAc (m_2), NaCl (m_3), dioxan (X), H_2O $(Y)|AgCl$–Ag, K has been determined for AcOH at 5° intervals from 5° to 45° in an 82% dioxan–H_2O mixture of dielectric const. $D = 9.3$ at 25°. K is max. at 15°. Log K does not vary linearly with $1/D$, but approx. linearly with the mol. fraction of dioxan at a given temp. This relationship has been expressed mathematically and a table of deviations is compiled from which K may be evaluated in all solvents containing from 0 to 82% of dioxan and at 5° intervals from 0° to 50°. W. R. A.

Dissociation constants of nitrophenols in deuterium oxide. D. C. MARTIN and J. A. V. BUTLER (J.C.S., 1939, 1366—1369).—From spectrophotometric measurements on solutions buffered with AcOH and NaOAc or with Na_2HPO_4 and KH_2PO_4 the relative dissociation consts. of o- and p-nitro- and 2 : 4-, 2 : 5-, 2 : 6-, and 3 : 5-dinitro-phenols in H_2O and D_2O have been determined. The ratio K_h/K_d increases as K_h decreases, the vals. lying close to the curve of Rule and LaMer (A., 1938, I, 515). Accurate results could not be obtained for m-$NO_2 \cdot C_6H_4 \cdot OH$,

but the val. of K_h/K_d appears to be abnormally high. J. W. S.

Activity coefficients of alkali halides at 25°. R. A. ROBINSON (Trans. Faraday Soc., 1939, 35, 1217—1220).—Isopiestic ratios (ratios of concns. giving equal v.p.) have been determined for KCl against NaCl, NaBr, and KBr for concns. up to 4M. The calc. activity coeffs. are tabulated, vals. selected for the reference salt, KCl, being higher than those previously used (cf. A., 1934, 1173) by the factor 770/766. F. L. U.

Relative osmotic coefficients of sodium and potassium chloride in deuterium oxide at 25°. R. A. ROBINSON (Trans. Faraday Soc., 1939, 35, 1220—1222).—Isopiestic ratios for KCl and NaCl in D_2O have been determined up to 3·5M-NaCl. The differences between these and the ratios in H_2O for the same mol. ratios NaCl : solvent are very small ($<0.5\%$), implying that the ratios of the osmotic coeffs. are almost the same at corresponding mol. ratios. F. L. U.

Activity coefficients of sulphuric acid and lanthanum chloride in aqueous solution at 25°. R. A. ROBINSON (Trans. Faraday Soc., 1939, 35, 1229—1233).—From isopiestic data (reference salt KCl) activity coeffs. of H_2SO_4 have been determined between 0·2 and 3M., and of $LaCl_3$ between 0·05 and 1·5M. F. L. U.

Potential of lithium amalgam and activity of lithium ion in isoamyl alcohol. F. I. TRACHTENBERG (J. Phys. Chem. Russ., 1939, 13, 200—205).—The e.m.f. of cells Li amalgam|LiCl in $C_5H_{11} \cdot OH|$ AgCl|Ag was measured. The activity coeff. of Li in dil. solutions agrees with the theory of Debye, if the mean radius of LiCl is 1·7 A. J. J. B.

Interaction of amino-acids and salts. III. Determination of the activities of calcium, barium, and strontium chlorides in amino-acid solutions by means of electrodes of the third kind. N. R. JOSEPH (J. Biol. Chem., 1939, 130, 203—217; cf. A., 1939, I, 23).—The electrode Pb, Hg|PbC_2O_4, CaC_2O_4, $Ca^{\cdot\cdot}$ has been studied in aq. $CaCl_2$ with and without the presence of $Na^{\cdot}$, $K^{\cdot}$, and $Mg^{\cdot\cdot}$. It attains equilibrium in $\not> 1$ hr. and yields stable reproducible potentials. Electrodes of this type have been used to study the activities of $CaCl_2$, $BaCl_2$, and $SrCl_2$ in the presence of glycine and $NH_2 \cdot CHMe \cdot CO_2H$ and the effects of these salts on the activity coeff. of the NH_2-acids. The results are in qual. agreement with the vals. deduced from solubility and f.p. measurements. J. W. S.

Activity of carbamide in aqueous solutions. A. I. KRASILSCHTSCHIKOV and S. S. TRAININA (J. Phys. Chem. Russ., 1939, 13, 281—285).—F.p. of aq. $CO(NH_2)_2$ solutions were measured and the activities calc. J. J. B.

Palladium–deuterium equilibrium. L. J. GILLESPIE and W. R. DOWNS (J. Amer. Chem. Soc., 1939, 61, 2496—2502).—The isotherms of Gillespie and Galstaun (A., 1937, I, 136) for Pd–H_2 at 250° and 280° have been confirmed. Isotherms for Pd-black–D_2 from 200° to 300° have been obtained. Extension

of the study of the Pd–D_2 system requires pretreatment of the Pd with H_2 to form the β-phase, owing to the reluctance of Pd to form the β-phase in presence of D_2. The isotherms of D_2 on pretreated Pd are reproducible. Under similar conditions the adsorption of D_2 is < that of H_2, and the D_2 isotherms are horizontal at pressures ~2·4 times those of the corresponding H_2 horizontals. The crit. solution temp. for Pd–D_2 is 276°, the crit. pressure 35 atm., and the crit. composition 0·25 atom D per atom Pd. The heat of dissolution per mol. D_2 increases with increasing $[D_2]$, and is 7760 g.-cal. per mol. for the conversion of the first into the second solid phase. The shape of the phase diagram indicates no Pd deuterides above 200°.　　　　　　　　　W. R. A.

Vapour pressure of aqueous solutions of sulphuric acid. S. SHANKMAN and A. R. GORDON (J. Amer. Chem. Soc., 1939, **61**, 2370—2373).—The v.p. of aq. H_2SO_4 (2—23M.), measured at 25° by the static method, agree with the data of Grollman and Fraser (A., 1925, ii, 398), and are consistent with those of Collins (A., 1934, 248) up to 8M. The results agree also with e.m.f. measurements up to 3M. (cf. Harned and Hamer, A., 1935, 301), but at higher concns. large deviations are observed. Vals. of the activity of the H_2O and of the activity coeff. of H_2SO_4 in the aq. solutions at various concns. are tabulated.
　　　　　　　　　W. R. A.

Sodium chloride solutions as an isopiestic standard. A. A. JANIS and J. B. FERGUSON (Canad. J. Res., 1939, **17**, B, 215—230).—The v.p. of an aq. solution of an inorg. salt can be accurately determined by rocking solutions of two salts contained in a Ag dish in an evacuated desiccator until equilibrium is attained. Analysis of the two solutions enables the v.p. of one solution to be calc. from the known v.p. of the other. $NaCl$ is used for the standard solution, and data for KCl at 25°, 30°, and 35° are presented. The calc. activity coeffs. for KCl solutions are in good agreement with vals. obtained by other methods. The choice of $NaCl$ as an isopiestic standard and the selection of standard v.p. vals. are discussed.　　　　　　　C. R. H.

Crystallisation of salicylic acid from mixtures of salicylic acid and α-naphthol. A. CASTIGLIONI (Gazzetta, 1939, **69**, 444—447).—For this system Volmer's relationship for the power of spontaneous crystallisation holds only in a restricted range of concn. and of temp.　　　　　　　O. J. W.

Dehydration of salt hydrates by entrainment distillation with liquids immiscible with water. F. G. H. TATE and L. A. WARREN (Trans. Faraday Soc., 1939, **35**, 1192—1200).—Curves are given of the dehydration of $CuSO_4,5H_2O$, $MnSO_4,4H_2O$, $FeSO_4,(NH_4)_2SO_4,6H_2O$, $MgSO_4,7H_2O$, $NiSO_4,7H_2O$, $ZnSO_4,7H_2O$, and $FeSO_4,7H_2O$, by distillation with liquids boiling at 80—160° (cf. B., 1936, 768). Breaks in the curves indicate the existence of the following hydrates: $CuSO_4,H_2O$; $MgSO_4,3$ and $2H_2O$; $FeSO_4,(NH_4)_2SO_4,2H_2O$; $NiSO_4,6$ and $4H_2O$; $FeSO_4,4H_2O$; $ZnSO_4,4$ and $1H_2O$; $MnSO_4,H_2O$.
　　　　　　　　　F. J. G.

Polytherms of system KCl–KH_2PO_4–H_2O from —10·8° to 35°. V. A. POLOSIN and M. I. SCHACH-

PARONOV (J. Phys. Chem. Russ., 1939, **13**, 541—546). —There is no evidence of double-salt formation, but there are indications of the existence of two polymorphic modifications of KCl and of a limited range of solid solutions of KH_2PO_4 in KCl. KCl has a powerful salting-out action on KH_2PO_4.　　R. C.

System PbO–B_2O_3–SiO_2. R. F. GELLER and E. N. BUNTING (J. Res. Nat. Bur. Stand., 1939, **23**, 275—283).—The system has been examined by quenching and petrographic examination, and the compound $5PbO,B_2O_3,SiO_2$, incongruent m.p. 551°, identified. The eutectic of lowest m.p. (484 ± 2°) occurs with PbO 84·5, B_2O_3 11, and SiO_2 4·5%. Optical and crystallographic properties of the various phases are recorded.　　　　　　　·　J. W. S.

Heat content and heat capacity of sodium chloride solutions. R. A. ROBINSON (Trans. Faraday Soc., 1939, **35**, 1222—1228).—Isopiestic ratios have been determined at concns. 0·1—1M. and between 15° and 60°. Activity coeffs. for both salts at 5° intervals are tabulated. Partial mol. heat contents and heat capacities are calc. and recorded.
　　　　　　　　　F. L. U.

Heat of formation of magnesium sulphide. A. F. KAPUSTINSKI and I. A. KORSCHUNOV (J. Phys. Chem. Russ., 1939, **13**, 276—277).—ΔH, measured directly, is —84,390±270 g.-cal.
　　　　　　　　　J. J. B.

Heat of formation of magnanese sulphide. A. F. KAPUSTINSKI and I. A. KORSCHUNOV (J. Phys. Chem. Russ., 1939, **13**, 278—280).—ΔH, measured directly for green MnS, is —48,750±520 g.-cal.　　　　　　　　　J. J. B.

Heat of decomposition of chlorine trioxide and the energy of the oxygen–chlorine bond. C. F. GOODEVE and A. E. L. MARSH (J.C.S., 1939, 1332—1337).—By means of the technique previously described (A., 1937, I, 518), the heat of decomp. of ClO_3 to Cl_2 and O_2 has been determined as 37±2 kg.-cal. per g.-mol. From this and known data the energy of the Cl–O bond in ClO_3 is calc., and compared with vals. similarly calc. for other Cl oxides. They range from 47 to 59·5 kg.-cal. per g.-mol., and the differences are accounted for by weakening due to steric repulsion in Cl_2O and Cl_2O_7, and by strengthening due to the bonding effect of the odd electron in ClO_2 and ClO_3. On this basis the normal val. for the · two-electron bond Cl·O is 52±1 kg.-cal. per g.-mol., and, allowing for the effect of the odd electron, the heat of decomp. of ClO to atoms would be ~67 kg.-cal. These vals. are applied to a discussion of reaction mechanisms among the Cl oxides.
　　　　　　　　　F. J. G.

Heats of dissolution of anhydrous chlorides of the rare earths. H. BOMMER and E. HOHMANN (Naturwiss., 1939, **27**, 583).—The heats of dissolution of anhyd. chlorides of the rare-earth elements have been determined. When plotted against at. no. of the element, the chlorides fall into three series: (I) La, Ce, Pr, Nd, Sm, Eu, and Gd; (II) Tb and Dy; (III) Er, Tm, Yb, Lu. The X-ray diagrams of the chlorides have also been determined, and the cryst. structures fall into three classes corresponding exactly

with the above. There is a comparatively large difference in the heat of dissolution in passing from $LaCl_3$ to $LuCl_3$ (31—51 kg.-cal.). The heat of dissolution of YCl_3 is not near that of $HoCl_3$, as might be expected, but is > that of any other rare-earth chloride.   A. J. M.

Heat of dissolution of normal paraffins. C. G. BOISSONNAS (Arch. Sci. phys. nat., 1939, [v], **21**, Suppl., 46—48; cf. A., 1936, 937).—The heats of dissolution of n-C_6H_{14} in C_6H_6 and CCl_4 are equal to the heats of dissolution of equal wts. of n-$C_{18}H_{38}$ in the same solvent. This accords with the view that each CH_2 of the hydrocarbon chain participates in the heat change and that the effect of the end groups diminishes with increasing length of the chain.   J. W. S.

Thermodynamic data for the *cyclo*hexane–methyl*cyclo*pentane isomerisation. G. E. MOORE and G. S. PARKS (J. Amer. Chem. Soc., 1939, **61**, 2561—2562).—The discrepancy between the vals. of Glasebrook *et al.* (A., 1939, II, 410) and Parks and Huffman for ΔH and $\Delta F°$ for the isomerisation of *cyclo*hexane to methyl*cyclo*pentane is due to small errors in the heats of combustion, which are re-determined.   R. S. C.

Electrical conductivity of uni-univalent salts in acetone. J. F. J. DIPPY, H. O. JENKINS, and J. E. PAGE (J.C.S., 1939, 1386—1391).—The Λ-$\sqrt{c}$ curves (Λ = equiv. conductivity, c = concn.) for NaI and KI in $COMe_2$ accord with the Onsager law at very low c, and Λ_0 vals. have been derived by extrapolation. At higher c the slope of the curve increases very gradually with increasing c. NH_4I in $COMe_2$ yields a curve of similar form, but the experimental slope is $\ll$ the theoretical val. With Na and K salicylates and $AgNO_3$ Λ increases only slowly with decreasing c over a wide range, and then increases suddenly. Computation of Λ_0 is impossible as no region is attained in which Onsager's equation is obeyed. LiI shows an intermediate behaviour. The results are consistent with the effects of interionic attraction and ion association on Λ. The data permit the calculation of satisfactory dissociation consts. for the salts.   J. W. S.

Rôle of electrons in the production of the electromotive force at the metal–electrolyte junction. V. KARPEN (Compt. rend., 1939, **209**, 474—476).—Theoretical. The necessity for considering the exchange of free electrons at the interface is emphasised. An expression for the p.d. at the junction is derived; the metal and electrolyte are regarded as immiscible liquids of widely different dielectric const. containing electrons and metallic ions and atoms in a state of dynamic equilibrium.   A. J. E. W.

Passivity of chromium. E. PULKKI (Svensk Kem. Tidskr., 1939, **51**, 174).—In presence of O_2 polished Cr behaves reproducibly as an O_2 electrode (cf. A., 1939, I, 525).   M. H. M. A.

Effect of temperature on aberrations of glass electrode in alkaline solution. V. A. PTSCHELIN (J. Phys. Chem. Russ., 1939, **13**, 490—494).—Deviations from the behaviour of the H electrode fall

with temp., perhaps owing to reduced mobility of the $Na^{\cdot}$ ions of the glass. In alkaline solutions the reproducibility of the electrode potential is so poor that the use of calibration curves and empirical correction formulæ is unjustifiable.   R. C.

Lead–iodine voltaic cell. W. C. VOSBURGH and V. H. DIBELER (J. Amer. Chem. Soc., 1939, **61**, 2522—2523).—The cell Pb (Hg)|PbI_2, $PbClO_4$ (m)| $PbClO_4$ (m), PbI_2, I_2|(Pt) is reproducible and maintains a const. e.m.f. over several months. It recovers its original e.m.f. after charge or discharge more quickly than the Weston cell. The average change in e.m.f. with temp. is 0·000042 v. per degree.   W. R. A.

Theory of overvoltage. H. EYRING, S. GLASSTONE, and K. J. LAIDLER (Trans. Electrochem. Soc., 1939, **76**, Preprint 26, 331—338).—It is suggested that in aq. solution layers of H_2O become attached to the electrodes and corresponding adjacent layers are associated with the solvent. H-overvoltage is attributed to the slow transfer of $H^{\cdot}$ from a H_2O mol. in the solvent to a H_2O mol. of the cathode layer, and O-overvoltage to the slow transfer of $H^{\cdot}$ from a H_2O mol. in the anode layer to a H_2O mol. in the solvent. The different overvoltages (η) found for different metals are ascribed to variations in the heat of activation (E) of the transfer process, in accord with the fact that metals which adsorb H_2 strongly have low H-η and high O-η. According to the theory MeOH, EtOH, AcOH, and $COMe_2$, which decrease the η at a Pb cathode, break up the H_2O structure and lower E, whilst the η-increasing effect of long-chain alcohols and acids is attributed to their adsorption on the electrode, reducing the area available for the H_2O film. It is suggested that in the discharge of Cl' ions the energy of activation required for the passage of the Cl' through the H_2O layers is low, and hence η is low.   J. W. S.

Polarisation and overvoltage with special attention to transfer resistance. A. L. FERGUSON (Trans. Electrochem. Soc., 1939, **76**, Preprint 14, 157—185).—Measurements of polarisation and overvoltage (η) by the direct and commutator methods show that the latter gives an average val. which is misleading and has inherent sources of error, the direct method giving true η vals. containing only active potentials capable of doing external work after the charging circuit has been opened. Evidence against the existence of transfer resistance is presented. Total η consists of two parts, one which falls rapidly with time and another which falls only slowly, the first component alone changing appreciably with c.d. The rate of transition from one type of η to the other varies greatly between different electrode materials and also between anode and cathode for the same material. No relation exists between total η and that part which falls rapidly with time. No present theory of η accounts satisfactorily for these observations.   F. H.

Overvoltage in the course of electrolytic deposition of mercury on tantalum. I. M. MALKIN (J. Phys. Chem. Russ., 1939, **13**, 194—199).—Hg was deposited from a solution of HgOAc in an atm. of H_2. The overvoltage was raised by EtOH

and little affected by $C_5H_{11}\cdot OH$ or Pr^aCO_2H. It is apparently independent of the interfacial tension between Hg and the solution. J. J. B.

Cathodic polarisation of nickel. O. ESSIN and M. LOSCHKAREV (J. Phys. Chem. Russ., 1939, **13**, 186—193).—The relation between c.d. and voltage of Ni in air-free $NiSO_4$ solutions was studied. The overvoltage (η) increased linearly with log c.d. at 55° and 60°, and more rapidly than linearly at 0°. Presumably at high temp. η is mainly due to a retarded discharge of Ni·, and at 0° to a slow formation of crystal nuclei. J. J. B.

Kinetics of complex reactions. N. SEMENOFF (J. Chem. Physics, 1939, **7**, 683—699).—Complex reactions of various types have been examined mathematically. W. R. A.

Quantum-mechanical considerations in the theory of reactions involving an activation energy. J. O. HIRSCHFELDER and E. WIGNER (J. Chem. Physics, 1939, **7**, 616—628).—Theoretical. W. R. A.

Theory of reaction rates. E. P. WIGNER (J. Chem. Physics, 1939, **7**, 646—650).—Theoretical. The nature of the energy surfaces of simple reactions is discussed and the theory of elementary association reactions is examined and modified. The rates of association of I, Br, and Cl atoms are calc. and compared with experimental data. W. R. A.

Intramolecular diffusion, quantum theory, and the calculation of unimolecular velocity constants. J. A. CHRISTIANSEN (J. Chem. Physics, 1939, **7**, 653—656).—Mathematical. Since internal rearrangement of mols. can be considered as the diffusion from one part of a potential energy surface to another, the application of ordinary diffusion equations might be possible. This viewpoint, which is alternative to the method of the activated state, is developed quantitatively. W. R. A.

Effusion and thermal transpiration in quantum statistics. B. N. SRIVASTAVA (Proc. Roy. Soc., 1939, **A**, **171**, 469—484).—The effusion of a gas from one vessel into another at a different temp. or pressure is considered. Expressions are worked out giving the relation between equilibrium pressures, obtaining in the steady state, for two chambers maintained at different temp. and communicating with each other through a narrow opening. The relation between the pressures when the matter in one chamber is degenerate and in the other non-degenerate is calc. G. D. P.

Cold flames. I—III. J. M. STEVELS (Chem. Weekblad, 1939, **36**, 638—642, 654—657, 657—663). —A review of recent developments in the technique of cold flames and their significance for studying the nature of the chemical bond. S. C.

Reaction between methyl radicals. H. A. TAYLOR and M. BURTON (J. Chem. Physics, 1939, **7**, 675—679).—A review of the data on the reactions of Me radicals with one another and with H_2 mols. indicates that (i) Me radicals combine only in three-body collisions the activation energy of which may reach 22 kg.-cal. per mol., (ii) Me radicals do not readily enter into two-body reactions with H_2 mols. the energy of activation being ~19 kg.-cal. per mol., and (iii) the three-body reaction $Me + H_2 + Me \rightarrow 2CH_4$ (activation energy 9 ± 2 kg.-cal. per mol.) probably accounts for the disappearance of the majority of the Me radicals in the presence of a high $[H_2]$. W. R. A.

Reactions involving hydrogen and hydrocarbons. E. GORIN, W. KAUZMANN, J. WALTER, and H. EYRING (J. Chem. Physics, 1939, **7**, 633—644). —The activation energies of the reactions $H + CH_4 = Me + H_2$ (I) and $D + CH_4 = MeD + H$ (II), calc. by a combination of the semi-empirical method and the treatment of directed valency of Van Vleck and Voge, are 9·5 and 37 kg.-cal. per mol. respectively. The result for (II) confirms the prediction (40 kg.-cal. per mol.) of Rice and Teller (A., 1938, II, 425). The energy surface corresponding with the reaction $H + CH_4$ contains a basin 8 kg.-cal. deep, corresponding with a stable Me–H–H mol. The observation of Farkas and Melville (A., 1937, I, 193), that H atoms recombine rapidly in presence of CH_4, is interpreted in terms of this Me–H–H intermediate. Data on H (and D) + hydrocarbon reactions are explained as atom-cracking reactions, e.g., $D + Et \rightarrow EtD \rightarrow MeD + Me$. W. R. A.

Mechanism of some chain reactions. F. O. RICE and K. F. HERZFELD (J. Chem. Physics, 1939, **7**, 671—673).—The mechanism of the decomp. of C_2H_6 previously proposed (A., 1934, 369) and the modification of Küchler and Theile (A., 1939, I, 326) have been examined in the light of data on the heat of activation of the decomp. W. R. A.

Explosion of ethyl azide in the presence of diethyl ether. O. K. RICE and H. C. CAMPBELL (J. Chem. Physics, 1939, **7**, 700—708).—Explosion limits and induction periods for the explosion of EtN_3 in presence of Et_2O are recorded and compared with data on the explosion of pure EtN_3 (A., 1935, 938; 1936, 33). The results support the contention that the explosion of EtN_3 is a thermal explosion. The heat of reaction is consistent with thermochemical data on related compounds. Application of the method of calculation of the heat of reaction to the data of Appin et al. (A., 1937, I, 190) on $MeNO_3$ gives a val. in disagreement with thermochemical data. The explosion of $MeNO_3$ is thus not a thermal explosion. W. R. A.

Kinetics of the oxidation of hydrogen sensitised by nitrogen dioxide. R. H. CRIST and J. E. WERTZ (J. Chem. Physics, 1939, **7**, 719—722).— During the investigation of the effect of NO_2 on the oxidation of H_2, the influence of walls, temp., and relative concns. of the substances on the reaction rate has been studied. The results are explained on the assumption of the formation of the NO_3 intermediate, which is also formed in the oxidation of CO in presence of NO. The influence of adsorption on the walls is emphasised. W. R. A.

Mechanism of complex reactions and the association of H and O_2. G. VON ELBE and B. LEWIS (J. Chem. Physics, 1939, **7**, 710—717).—A crit. review covering data on the kinetics of (i) the upper explosion

limit and the non-thermal explosion of H_2 and O_2, (ii) the Hg-sensitised H_2–O_2 reaction, and (iii) the O_2-inhibited photosynthesis of HCl, reactions which furnish information on the formation and destruction of HO_2. The reactions of HO_2 in a mixture of H_2, Cl_2, O_2, and HCl are discussed.　　　W. R. A.

Carbon monoxide–oxygen flame. V. Influence of temperature on the yield of visible light of a flame of $2CO + O_2$. E. KONDRATEEVA and V. KONDRATEEV (J. Phys. Chem. Russ., 1939, **13**, 169—173; cf. A., 1938, I, 577).—The temp. of the flame $\propto$ the rate of burning between 700° and 1000°. The yield of light increases with the % p of CO escaping the combustion. When p is high (e.g., 90%) the yield is independent of temp.; it diminishes with rising temp. at $p = <50\%$. This decrease cannot be attributed to a quenching effect of CO_2 as CO_2 is less effective than O_2.　　　J. J. B.

Mechanism of formation of oxides of nitrogen in explosion of inflammable mixtures. A. G. ELKENBARD, R. I. GENKINA, and M. V. POLJAKOV (J. Phys. Chem. Russ., 1939, **13**, 464—472).—The yield of NO in the explosion of mixtures of CH_4, O_2, and N_2, and of CO, O_2, and N_2 passes through a max. with increase in the diameter of the spherical reaction vessel, an observation which agrees with the theory that the NO is formed by termination of reaction chains in the extended phase, not on the wall.　　　R. C.

Kinetic investigation of the phenomena of combustion of mixtures of hydrogen, carbon monoxide, and oxygen. M. PRETTRE (Mém. Poudres, 1939, **29**, 283—327).—In the heterogeneous combustion of CO–O_2 and H_2–CO–O_2 mixtures in Pyrex glass coated with a glow-eliminating composition the rate of oxidation of the former mixture is $<$ that of the latter, which confirms the fact that in many ternary mixtures of CO and H_2 it is only the latter that controls the rate of oxidation. On the other hand, this accelerating effect of H_2 is much less pronounced with feeble concns. of the gas or with high content of the combustible gases, and it may even change to an inhibiting action. These mixtures are the only ones in which the temp. of ignition is appreciably raised when a hot wall of glow-eliminating salt is substituted for the Pyrex. Tests with KCl showed that the mixtures could be put into three classes according to the inhibiting effect of KCl on their combustion, i.e., mixtures poor in O_2 and not very rich in H_2, those rich in H_2 and of variable O_2 content, and those poor in H_2 and with excess or only slight deficiency of O_2. The slowing-up of the rate of oxidation by KCl is marked only with a small no. of mixtures, especially those of which the O_2 content is low and the transformation controlled by the mechanism of combustion of the O_2–H_2 mixtures at low pressures.　　　W. J. W.

Kinetics of the oxidation of cobalt[ous salt solutions]. M. CHÂTELET and R. JOUAN (Compt. rend., 1939, **209**, 348—350).—The kinetics of the rapid oxidation of Co^{II} salt solutions cannot be determined directly from the O_2 pressure (p) variation, owing to the non-isothermal conditions. A graphical method

for correcting the experimental p–θ curve for this defect is described.　　　A. J. E. W.

Hydrogen and deuterium exchange between nitramide and water. V. K. LA MER and S. HOCHBERG (J. Amer. Chem. Soc., 1939, **61**, 2552—2553).—Dideuteronitramide, $D_2N_2O_2$, prepared by interaction of K nitrocarbamate and 99% D_2O and SO_3, decomposes in H_2O at the same rate as $H_2N_2O_2$. $H_2N_2O_2$ exchanges both H atoms with D atoms in D_2O. Both these facts indicate that the rate-determining factor for exchange between $H_2N_2O_2$ and D_2O involves $D_2N_2O_2$.　　　W. R. A.

Nature of the critical complex and the effect of changing medium on the rate of reaction. G. SCATCHARD (J. Chem. Physics, 1939, **7**, 657—662).—The nature of the crit. complex may often be related to the change of the rate of the corresponding reaction when the solvent medium is varied by altering either the electrolyte concn. or the dielectric const. The ratio of the vol. concn. to mol fraction, the possibility of catalytic action, and the possibility that the complex may change in nature with change in composition must be considered. The crit. complex of the $Na_2S_2O_3$–$CH_2Br\cdot CO_2Na$ reaction is probably the two tangent ions. The effect of changing dielectric const. on the solvolysis of Bu$^\gamma$Cl suggests a rather wide separation of the ions in the crit. complex.　　　W. R. A.

Functional relation between the constants of the Arrhenius equation. Formation of a series of quaternary ammonium salts in benzene-nitrobenzene mixtures. H. C. RAINE and C. N. HINSHELWOOD (J.C.S., 1939, 1378—1383).—The rates of the reactions between MeI and NEt_3, Pr$^\beta$I and C_5H_5N, and Pr$^\beta$I and NEt_3, in C_6H_6–$PhNO_2$ mixtures, have been determined at a no. of temp. The plots of E against composition of solvent have the same form as for the reaction between MeI and C_5H_5N (A., 1937, I, 570), whilst the variation of the term $\log PZ$ can be analysed as a steady increase with the polarity of the solvent superimposed on a linear variation with E, which is greatest for $NEt_3 + $ MeI and least for $C_5H_5N + $ Pr$^\beta$I. The interpretation of the correlation between E and P is discussed.　　　F. J. G.

Kinetics of chlorine, iodine chloride, and bromine chloride addition of olefinic compounds. E. P. WHITE and P. W. ROBERTSON (J.C.S., 1939, 1509—1515).—The additions of Cl_2 to cis- and trans-cinnamic acid (I) in $PhNO_2$, and to (I), crotonic acid, cinnamaldehyde, and crotonaldehyde in AcOH, are bimol., whilst those of ICl to allyl acetate and acrylic acid in AcOH and of IBr to (I) in AcOH + CCl_4 are termol. The addition of ICl is retarded, and in some cases completely inhibited, by HCl, apparently owing to formation of $HICl_2$, and moreover the reaction then becomes bimol. A possible mechanism for the termol. addition is put forward and discussed.　　　F. J. G.

Kinetics of bromine addition to olefinic compounds. II. Homogeneous mechanisms. I. K. WALKER and P. W. ROBERTSON (J.C.S., 1939, 1515—1518).—In the addition of Br to allyl acetate (I), succinate, and malonate, at concn. $\sim$M./40 in

AcOH at 25°, the predominant termol. addition (cf. A., 1937, I, 249) is accompanied to a small extent by a bimol. addition, which becomes predominant at high dilution, or in aq. AcOH, or at higher temp., the termol. reactions having $E \sim 3000$ g.-cal., and the bimol. reactions having $E \sim 9000$ g.-cal. The reaction between Br and (I) at high dilution in AcOH proceeds to completion in the dark but not in light. The addition of Br to phenylpropiolic acid in AcOH and in $PhNO_2$ at 25° is termol. F. J. G.

Kinetics of the sulphonation of nitrobenzene by sulphur trioxide. D. R. VICARY and C. N. HINSHELWOOD (J.C.S., 1939, 1372—1378).—The kinetics of the sulphonation of $PhNO_2$ by SO_3 dissolved in it have been studied at 25—100°. Sulphone formation, and the rate of sulphonation by traces of H_2SO_4, are negligible. The reaction is approx. bimol. with respect to SO_3, and is complicated by compound-formation between $NO_2 \cdot C_6H_4 \cdot SO_3H$ and SO_3. At the lower temp. it is retarded by H_2SO_4. E is 11,400 g.-cal., and log PZ is 3·91. F. J. G.

Kinetics of oxidation of organic compounds by potassium permanganate. I. Cyclic compounds; 2:6-dinitrophenol. E. A. ALEXANDER and F. C. TOMPKINS (Trans. Faraday Soc., 1939, 35, 1156—1165).—The oxidation of 2:6-dinitrophenol in aq. solution by $KMnO_4$ in presence of dil. H_2SO_4 ($\not> 0 \cdot 3$N.) has been studied at 20—35°. With [H·] $\not> 0 \cdot 0615$ the $KMnO_4$ is reduced to MnO_2 and there is an induction period. With [H·] $> 0 \cdot 0615$ there is no induction period and some reduction to $Mn^{..}$ occurs. The neutral salt effect is negligible. The initial rate is accelerated by $Mn^{..}$ but not by MnO_2 except at [H·] $> 0 \cdot 0615$. F′ retards the reaction. The heat of activation is 14,400 g.-cal. Hinshelwood's interpretation of the induction period (cf. A., 1936, 569) is rejected, and instead a mechanism is proposed involving slow reduction of MnO_4' to $Mn^{....}$ ions, these reacting with H_2O as follows : $Mn^{....} + H_2O = Mn^{...} + H· + OH$, and the OH radicals being the active oxidising agent. F. J. G.

Kinetics of bimolecular reactions in solution. V. A. GOLDSCHMIDT and N. K. VOROVIEV (J. Phys. Chem. Russ., 1939, 13, 473—482).—The rates of reaction of $NPhMe_2$ and C_5H_5N with CH_2PhCl and of p-chloro-, m-chloro-, and p-bromo-dimethylaniline with allyl bromide in solution have been determined. With $COMe_2$, $PhNO_2$, and $COPhMe$ as solvents the energy of activation and the B factor in Arrhenius' equation are small, whilst they are both large when the solvent is an alcohol. Application of Wynne-Jones and Eyring's theory (A., 1935, 1205) indicates that the velocity coeff. of a bimol. reaction should approach a limiting val. as the concns. fall and that for a given reaction B should vary little with the solvent. It is inferred that the solvent participates in the above reactions. R. C.

Hydration of unsaturated compounds. VII. Rate of hydration of crotonic acid. Rate of dehydration of β-hydroxybutyric acid. Equilibrium between these acids in dilute aqueous solution. D. PRESSMAN and H. J. LUCAS (J.

Amer. Chem. Soc., 1939, 61, 2271—2277; cf. A., 1937, II, 399).—The reaction, $CHMe:CH \cdot CO_2H$ (I) $+ H_2O \rightarrow OH \cdot CHMe \cdot CH_2 \cdot CO_2H$ (II), and its reverse in N-$HClO_4$, at 90·03° and 111·31° are first-order with respect to the concn. of acid and [H·]. The energies of activation are 38·0 and 48·1 kg.-cal., respectively, the difference being $>$ for the aldehydes owing to lower loss of resonance energy on hydration of the acid. $Na·$ increases the activity coeff. of (II) more than that of (I), thus shifting the equilibrium towards (I). R. S. C.

Relative rates of alcoholysis of certain aralkyl p-nitrobenzoates. L. F. KING (J. Amer. Chem. Soc., 1939, 61, 2383—2387).—The relative rates of alcoholysis of p-$NO_2 \cdot C_6H_4 \cdot CO_2X$ (X = CH_2Ph, α- and β-C_2H_4Ph, α-, β-, and γ-C_3H_6Ph, α- and β-$isoC_3H_6Ph$) in MeOH, MeOH–Et_2O, and EtOH–Et_2O have been studied by two methods which are described. The speed of alcoholysis with MeOH is $>$ with EtOH. The relative reactivity of the 8 aralkyl groups depends largely on the mol. wt. of the aryl alcohol and on the nature of the functional OH groups, and, to a smaller extent, on the position of the Ph ring in the mol. W. R. A.

Hydrolysis of ethylal. P. M. LEININGER and M. KILPATRICK (J. Amer. Chem. Soc., 1939, 61, 2510—2514).—The velocity coeff. $k_{H_2O}^+$ for the hydrolysis of $CH_2(OEt)_2$ has been measured over a [HCl] range from 0° to 40°. The effect of [HCl] on $k_{H_2O}^+$ decreases with increasing temp. A decrease in the energy of activation with increasing [HCl] has been observed, and is tentatively explained on the basis of a pre-equilibrium. W. R. A.

Addition of oxygen to double linkings.—See A., 1939, II, 514.

Kinetics of thermal decomposition of vitamin-B_1 hydrochloride in aqueous solution.—See A., 1939, III, 920.

Action of oxides on dilute solutions of potassium permanganate. E. MONTIGNIE (Bull. Soc. chim., 1939, [v], 6, 1425—1428).—Dil. $KMnO_4$ oxidises $CrO_2,2H_2O$ to $K_2Cr_2O_7 + H_2CrO_4$, Cu_2O (I) and CuOH (II) to $Cu(OH)_2$, and SnO (III) and $Sn(OH)_2$ (IV) to $Sn(OH)_4 + K_2Sn(OH)_6$, being itself reduced to MnO_2,H_2O in all cases. The rate of reaction is high at first but decreases rapidly to an almost const. val., and for (II) and (IV) is $\gg$ for (I) and (III). F. J. G.

Mechanism of carbon combustion on the carbonyl group theory. V. SIHVONEN (Suomen Kem., 1939, 12, B, 20—23).—The author's theory (A., 1939, I, 365) is developed. The primary process in oxidation of C is the adsorption of O_2 by a C atom having two free valencies, to give $:CO_2$. This is confined to corner (diamond) and edge (graphite) atoms, and is irreversible. The reversible adsorption of O_2 on the surfaces of graphite hexagons is pictured as $>C-C<$. The adsorbate is readily mobile and may migrate to the free edges, where it is irreversibly adsorbed. Since the irreversible adsorption is the rate-determining reaction in the oxidation, supply of O_2 from the hexagon surfaces rather than from the gas phase may

alter the apparent order of the reaction from 0 to 1. Keto-groups, formed especially by the reaction: $>C + CO \rightarrow >C\dot{:}C\dot{:}O$, are very stable and inhibit the oxidation by blocking the primary centres. The primary unit $\dot{:}CO_2$ gives single keto-groups, moderately stable, and α-diketo-groups which at once decompose to 2 CO. The structure $>C\overset{O}{\overbrace{}}C<$ probably also takes part. The results of 20 studies in the lit. of the action of CO_2, O_2, and H_2O on diamond, graphite, and amorphous C are explained on the basis of the author's theory.   M. H. M. A.

Thermal decomposition of crystals of barium azide. A. WISCHIN (Proc. Roy. Soc., 1939, A, 172, 314—325).—The reaction was studied at 100°, 115°, and 123·5°, by measuring the rate of rise of pressure of N_2 and microscopical observation of the formation of nuclei of metallic Ba. At const. temp. the pressure increases as t^6—t^8 (t = time). The radii of the nuclei increase linearly and their no. with t^3. The activation energies are deduced.   G. D. P.

Decomposition of metallic azides. N. F. MOTT (Proc. Roy. Soc., 1939, A, 172, 325—335).—A theoretical discussion of the thermal decomp. of azides is based on the Wagner–Schottky theory of ionic conductivity and the electron theory of solids. The formation of metallic nuclei, the nature of the induction period, the way in which the nuclei catalyse the reaction, and the effect of ultra-violet light are considered. The relation of the reaction to the photochemical reduction of Ag halides is pointed out. (Cf. preceding abstract.)   G. D. P.

Rate of dissolution of iron in acids. M. B. ABRAMSON and C. V. KING (J. Amer. Chem. Soc., 1939, 61, 2290—2295).—The rate of dissolution of pure Fe in solutions of several acids (HCl, HClO$_4$, HNO$_3$, H$_2$SO$_4$, AcOH, tartaric acid) in the presence of depolarisers (KNO$_3$, H$_2$O$_2$, KNO$_2$, p-NO$_2$·C$_6$H$_4$·OH) has been studied as a function of the concns. of depolariser, acid, and added salts, the stirring speed, and the temp. Only KNO$_3$ was effective as a depolariser. The rate was also measured in aq. FeCl$_3$ of various concns. alone and in presence of acid. Two mechanisms control the rate of dissolution, (a) diffusion (under all conditions in FeCl$_3$; at low stirring speeds in HCl in presence of sufficient KNO$_3$; in HNO$_3$ with certain [Cl']); and (b) a slower reaction probably of chemical nature at the Fe surface which holds for all other conditions. When the rate of dissolution is controlled by diffusion the temp. coeff. $\simeq$1·35 per 10°, whereas the chemically-controlled dissolution has a temp. coeff. of ~2·2 per 10°.   W. R. A.

Transition of the combustion of explosives into detonation.—See B., 1939, 1078.

Transmission of detonation from gases to explosives.—See B., 1939, 1078.

Rate of oxidation of steels.—See B., 1939, 1046.

Kinetics of reactions of different ionic types in solution. I. N. V. SAPOSHNIKOVA (J. Phys. Chem. Russ., 1939, 13, 174—185).—The reaction CH$_2$Cl·CO$_2$Et (I) + NH$_3$, aq. = CH$_2$Cl·CO$_2$NH$_4$ + EtOH in aq. EtOH is accelerated by Na$_2$SO$_4$ > by

NaCl. The hydrolysis of (I) by HCl is accelerated by NaCl and retarded by Na$_2$SO$_4$. The reaction between (I) and Na$_2$S$_2$O$_3$ in aq. EtOH is retarded by NaCl and Na$_2$SO$_4$. Alkaline saponification of (CH$_2$·CO$_2$Et)$_2$ to CO$_2$H·[CH$_2$]$_2$·CO$_2$Et (II) is accelerated by Na$_2$SO$_4$ and retarded by NaCl, whilst the hydrolysis of (II) is accelerated by NaCl > by Na$_2$SO$_4$. The activation energy of these reactions is calc. and their mechanism discussed.   J. J. B.

Acid catalysis in amines. II. Catalytic effect of various butylammonium salts on the aminolysis of ethyl phenylacetate in anhydrous n-butylamine. P. K. GLASOE, J. KLEINBERG, and L. F. AUDRIETH (J. Amer. Chem. Soc., 1939, 61, 2387—2389).—The catalytic effect of equimol. concns. of various salts NH$_2$Bu,X (where X = an acid) on the aminolysis of CH$_2$Ph·CO$_2$Et in anhyd. NH$_2$Bu^a to yield CH$_2$Ph·CO·NHBu decreases with the anion in the order Cl' > OAc' > OBz' > Br' > NO$_3$' > CNS' > I' > ClO$_4$'.   W. R. A.

Reactions in concentrated sulphuric acid. VII. Kjeldahl catalysts. VIII. Equilibrium states with [Kjeldahl] catalysts. J. MILBAUER (Chem. Obzor, 1936, 11, 208—211, 233—240; Chem. Zentr., 1937, i, 1692, 2730; cf. A., 1939, I, 88).—VII. The effectiveness of catalysts in accelerating the kjeldahlisation of sucrose increases in the following order : (at the b.p. of H$_2$SO$_4$) no catalyst, Ni, As, Pd, Sb, Pt, V, Au, Te, Cu, Hg, Se; (at 302°) Ni, no catalyst, As, Ag, Pd, Au, Sb, Pt, Hg, Cu, Te, V, Se. Ag$_2$SO$_4$ has little effect. If the time required for kjeldahlisation of 100 g. of sucrose by 100 g. of H$_2$SO$_4$ be taken as 1, the times in presence of 140, 374, 100·4, and 161 mg. of SeO$_2$, HgO, CuO, or Te are $\frac{1}{15}$, $\frac{1}{15}$, $\frac{1}{3\frac{1}{5}}$, and $\frac{1}{4}$, respectively. The best mixtures are SeO$_2$ + HgSO$_4$ ($\frac{1}{15}$) and SeO$_2$ + CuSO$_4$. SeO$_2$ + HgSO$_4$ + 2CuO is less effective.

VIII. Kjeldahl catalysts are of two types, which are active in (a) homogeneous or (b) heterogeneous systems. The action of type (a) (CuSO$_4$, HgSO$_4$, Ag$_2$SO$_4$, SeO$_2$, TeO$_2$) is closely related to solubility effects. With type (b) (Pt metals) the solid exists in equilibrium with dissolved catalyst, owing to simultaneous reduction of the latter by org. oxidation products, and dissolution of solid material. Catalytic activity is mainly associated with the dissolved portion, but may be confined to the surface if no reducing substance is present to maintain the oxidation–reduction cycle. Individual catalysts are discussed in detail, and the following decreasing order of activity for kjeldahlisation at 302° is obtained : Se, Hg, Mo, Te, V, Cu, W, Sn, Si, B, Na, As, Li, Ag, Ba, Ca, K, Zn, Al, Pd. Se is recommended for N determinations.   A. J. E. W.

Catalytic properties of phthalocyanines in oxidations.—See A., 1939, II, 488.

Promotors in catalytic reactions of ferric oxide hydrates. A. QUARTAROLI (Gazzetta, 1939, 69, 443—444).—A claim of priority (cf. Krause, A., 1939, I, 207).   O. J. W.

Theory of reactions on porous or powdered materials. J. B. ZELDOVITSCH (J. Phys. Chem. Russ., 1939, 13, 163—168).—When a layer of powder

reacts with a gas or catalyses a gas reaction the superficial part has more opportunity for reaction than that underneath. The depth to which a reaction penetrates is calc.; it is inversely $\propto$ the square root of the velocity coeff. of the reaction.   J. J. B.

Reduction of silver ions by hydroxylamine. T. H. JAMES (J. Amer. Chem. Soc., 1939, **61**, 2379—2383).—The reduction of Ag· ions by NH_2OH is catalysed by colloidal Au (I) and more strongly by colloidal Ag (II). As the (I)-catalysed reaction proceeds, however, the Au particles become Ag-coated and the rate changes to that of a (II)-catalysed reaction. The rate of Ag formation is identical with that of N_2 evolution. Both reactions involve the NH_2O' ion as the active reducing reagent, and the kinetics of the (II)-catalysed reaction suggest that this ion is adsorbed to the Ag by the NH_2 group. Ag· ion adsorption is indicated for both reactions. At p_H 3·7 the reaction rate $\propto$ concn. of reducing agent, but as the p_H increases this dependence diminishes and at p_H 8·5 the rate depends on the 0·3 power of the concn. The catalysed reduction may be expressed by $Ag· + NH_2O' \rightarrow Ag + N + H_2O$, the NH_2O radical, if ever formed, decomposes at a rate $\gg$ the reduction process.   W. R. A.

Effect of carbon dioxide on rate of reduction of magnetite and hæmatite by carbon monoxide. E. P. TATIEVSKAJA and G. I. TSCHUFAROV (J. Phys. Chem. Russ., 1939, **13**, 495—501).—CO_2 retards the initial stages of reduction of Fe_3O_4 considerably at 500°, but only slightly at 900°. The rate of the initial stages of the reduction $Fe_2O_3 \rightarrow Fe_3O_4$ is scarcely affected, but when a sufficiently thick film of Fe_3O_4 has been formed on the surface the effect of CO_2 is as above. The theory of reduction mechanism previously advanced (A., 1938, I, 203) leads to vals. for the rates of reduction both by CO and by CO + CO_2 agreeing with the observed vals. Account must be taken of the above results in evaluating the reducibility of ores.   R. C.

Reaction between nitric acid and tin in presence of catalysts. II. G. S. KASBEKAR and A. R. NORMAND (Proc. Indian Acad. Sci., 1939, **10, A**, 37—40; cf. A., 1937, I, 251).—The reaction between HNO_3 and Sn is retarded by NaI and KI. No reaction occurs for 3 months when M. solutions of LiI, NaI, or KI are added. Then red, needle crystals of SnI_2 appear owing to the action of HI on Sn.   W. R. A.

Formation of catalytically active "ensembles" on surfaces. II. Application of theory to synthesis of ammonia and to catalytic and electrocatalytic hydrogenation of the ethylene bond. N. I. KOBOSEV and L. L. KLATSCHKO-GURVITSCH (Acta Physicochim. U.R.S.S., 1939, **10**, 1—24; cf. A., 1939, I, 271).—For the synthesis of NH_3 on Fe the no. of atoms in an active " ensemble " is calc. to be 3; the same is true of Pt in the oxidation of H_2 by O_2. In the reduction of fumaric acid by H_2 on Pt, and in the cathodic reduction of $CHPh:CH·CO_2H$ (Fe–Pt cathode), the active aggregates contain 2, and in the hydrogenation of C_2H_4 on Pt–Ni, 4 atoms. In no case does the no. of atoms reach the no. in the face of a unit cell of the cryst. metal. The mechanism of the reactions studied is discussed.   F. L. U.

High-pressure hydrogenation of low-temperature tar. XIII. Comparison of carriers for molybdenum catalysts.—See B., 1939, 1013.

Catalysts for synthesis of liquid hydrocarbons from carbon monoxide and hydrogen.—See B., 1939, 1020.

Regeneration of copper–nickel [fat] catalysts. —See B., 1939, 1053.

Rate of dissolution of zinc and aluminium while cathodic. B. P. CALDWELL and V. J. ALBANO (Trans. Electrochem. Soc., 1939, **76**, Preprint 9, 101—113).—The rate of corrosion of Zn cathodes in aq. HCl + H_2O_2 has been studied at various c.d. and at various temp. The corrosion of Al cathodes has also been studied in aq. HCl + H_2O_2, aq. NaOH, and aq. Na_2SO_4. It is inferred that the decrease in rate of corrosion observed when a metal normally attacked by an acid solution is made cathodic in such a solution is due to a decrease in the [H·] at the surface, resulting from slowness in the diffusion of H· through the cathode film. When a metal is made cathodic in neutral salt solution the decrease in [H·] results in an increase in [OH'], and if the c.d. is high enough the metal may undergo alkaline corrosion. The thickness of the cathode film impedes the diffusion of OH' and fosters corrosion. When the metal is made cathodic in strongly alkaline solution the increase of [OH'] is small, and hence the normal rate of corrosion in such a medium is observed. Rotation of the cathode decreases the thickness of the cathode film and hence reduces the effect of the applied potential.   J. W. S.

Nature of the cathode in the rusting of iron. S. BRENNERT (Trans. Electrochem. Soc., 1939, **76**, Preprint 8, 93—100).—When plates of cast Fe and Armco Fe are suspended in a stream of aërated aq. NaCl the Armco Fe is cathodic towards the cast Fe and the latter is the more severely corroded. The inclusions of impurity (C, Fe_3C, etc.) have no cathodic properties in this solution. The air-formed oxide layers are probably the cathode areas during corrosion, which occurs at points where the oxide film breaks down.   J. W. S.

Cathode reactions in metallic corrosion. T. P. HOAR (Trans. Electrochem. Soc., 1939, **76**, Preprint 18, 217—224).—A discussion of recent work.   F. H.

Behaviour of cadmium and arsenic in nickel [plating] baths.—See B., 1939, 1050.

Electrolytic preparation of sodium arsenate.—See B., 1939, 1034.

Electrolysis of organic compounds with alternating current. J. W. SHIPLEY and M. T. ROGERS (Canad. J. Res., 1939, **17, B**, 147—158).—Electrodes of Pt, Au, and C are the most satisfactory for the a.c. electrolysis of org. compounds. Variation of electrolysis conditions with a.c. is similar to that with d.c. Oxidation predominates over reduction, owing, probably, to the relatively low H overvoltage on the the electrodes. The yield with a.c. is generally $<$

that with d.c., although it may often be increased by using high c.d.; thus, with an a.c. c.d. of 3 amp. per sq. cm. a 50% oxidation of quinol is obtained.

D. F. R.

Chemical reactions in electric discharge. IV. Recombination of nitrogen atoms on metals. N. J. BUBEN and A. B. SCHECHTER (J. Phys. Chem. Russ., 1939, 13, 267—271).—The reaction $2N \rightarrow N_2$ is strongly accelerated by Cu, Fe, Ag, and Ni at room temp.; its rate can be measured by observing the rise of temp. of the metal. The catalytic activity of Ni is max. at 1200—1350° and becomes small above 1400—1500°. Presumably the adsorption of N by Ni at high temp. is so small that the probability of a collision between a N atom from the gas and an adsorbed N atom becomes negligible. J. J. B.

Volume and surface processes in the oxidation of nitrogen in the glow discharge. II. B. A. KONOVALOVA and N. I. KOBOSEV (J. Phys. Chem. Russ., 1939, 13, 286—300).—The part of the formation of NO taking place at the surface is presumably due to a reaction between N_2^+ and adsorbed O_2^- ions. The relation between the rate of this surface reaction and the size of the reaction vessel is similar to that between the size of the vessel and the rate of recombination of ions as determined by the min. discharge potential. In mixtures containing much O_2, H_2O and NH_3 increase the yield of NO; this is presumably due to oxidation of N_2 by H_2O and, respectively, to oxidation of NH_3. CO and CO_2 also raise the yield of NO. (Cf. A., 1939 I, 480.)

J. J. B.

Action of hydrogen and nitrogen on a not degassed graphite electrode during glow discharge. R. NÄSÄNEN (Suomen Kem., 1939, 12, B, 19—20).—A glow discharge through H_2 (1 mm. Hg) with a graphite cathode (not previously degassed) and Ni anode gave CO and CO_2 (CH_2O ?), but no hydrocarbons. No gas at all was obtained with the electrodes reversed. With N_2 the graphite cathode disintegrated and a brown deposit formed on the walls of the discharge tube. Monomeric C_2N_2 was not detected. M. H. M. A.

Preparation of acetylene in the interrupted discharge. M. J. KUSCHNEREV and A. B. SCHECHTER (J. Phys. Chem. Russ., 1939, 13, 259—266).—When a condenser was repeatedly discharged through anthracene oil the gas above the oil contained ≯30% of C_2H_2. The expenditure of electric energy per mol. of C_2H_2 increases with increasing capacity of the condenser and increasing resistance of the circuit. J. J. B.

Helium and the rare gases. Combination of helium with uranium by cathodic activation and the thermal decomposition of the complex. H. DAMIANOVICH (Anal. Asoc. Quím. Argentina, 1939, 27, 64—73).—Powdered U deposits on the cathode of a discharge tube employing 600—1200 v., 10—15 ma., absorb 6—9 cu. mm. He per mg. This complex decomposes endothermically and is less stable than those of He with Pt, Fe, and Pd, max. decomp. occurring at 60—80°. It follows that the presence of He in rocks is not necessarily associated with radioactivity. F. R. G.

Photo-conductance of dye-sensitised silver bromide and the mechanism of dye-sensitisation. I. N. KAMEYAMA and T. FUKUMOTO (J. Soc. Chem. Ind. Japan, 1939, 42, 244B).—AgBr plates (100 μ.) show a max. photo-conductivity when illuminated by light of 454—458 mμ. When sensitised by dyes additional photo-conductivity max. are found at the following $\lambda\lambda$ (mμ.): erythrosin, 560; cryptocyanine 745; dicyanine 670 and 568. In each case these max. correspond with regions of photographic sensitivity. It is concluded that electrons are elevated to the conduction band by the energy absorbed by the adsorbed sensitiser dye. O. J. W.

Sensitivity of photographic emulsions for 50—100-ke.v. electrons. L. MARTON (Physical Rev., 1939, [ii], 56, 290).—The relative blackening of 12 types of emulsion, determined for exposures of 10^{-3}—1 sec., is plotted with reference to a standard emulsion. Results indicate that for a low val. of blackening X-ray films are the more sensitive, and for higher vals. of blackening the process type emulsions are more suitable. N. M. B.

Photographic reciprocity law at low temperature. C. H. EVANS and E. HIRSCHLAFF (J. Opt. Soc. Amer., 1939, 29, 164—167).—With four different emulsions, the failure of the reciprocity law is entirely absent at −186°. L. J. J.

Failure of the photographic reciprocity law at low intensity. J. H. WEBB and C. H. EVANS (J. Opt. Soc. Amer., 1939, 29, 225; cf. ibid., 1938, 28, 431).—Weinland's priority is acknowledged. L. J. J.

Action of ultra-violet radiation on barium and strontium azides. W. E. GARNER and J. MAGGS (Proc. Roy. Soc., 1939, A, 172, 299—314).—The effect of irradiation by ultra-violet light on the thermal decomp. of the azides was studied. The threshold for absorption by N_3' ions in solution and in the solid state is the same as that for the photochemical reaction. Pre-illumination by ultra-violet light shortens the induction period in the decomp. of BaN_6; prolonged illumination produces nuclei of metallic Ba at room temp. The reaction is not affected by the application of electrostatic fields up to 1250 v. per cm. G. D. P.

Photochemical decomposition of benzene vapour. I. G. I. KRASINA. **II.** N. A. PRILESHAEVA (J. Phys. Chem. Russ., 1939, 13, 483—485, 486—489).—I. In radiation of $\lambda < 2100$ A. the vapour decomposes into H and Ph, most of the H subsequently forming H_2.

II. The rate of decomp. has been determined. The results are interpreted in terms of potential curves. R. C.

Quantum yield of monochloroacetic acid hydrolysis. R. N. SMITH, P. A. LEIGHTON, and W. G. LEIGHTON (J. Amer. Chem. Soc., 1939, 61, 2299—2301).—The quantum yield of the hydrolysis of $CH_2Cl\cdot CO_2H$ (I), based on the amount of Cl' ion produced by irradiation with the Hg 2537 A. line, is < recorded vals. and varies with temp. from 0·31 at 25° to 0·69 at 69°. The yield is independent of the intensity of irradiation and of concn. The follow-

ing mechanism, involving competition between de-activation and decomp., is suggested to account for the temp. variation : (I) $+ h\nu \to CH_2Cl \cdot CO_2H^*$ (II), (II)$+ M \to$ (I), (II)$+ 2H_2O \to OH \cdot CH_2 \cdot CO_2H + H_3O^{\cdot} + Cl'$. The relation of these data to publications in which this hydrolysis has been used as an actino-meter is discussed.   W. R. A.

Photochemical studies. XXIX. Decomposition of diethyl ketone at short wave-lengths. Comparison of acetone, methyl ethyl ketone, and diethyl ketone near 3000 A. V. R. Ells and W. A. Noyes, jun. (J. Amer. Chem. Soc., 1939, **61**, 2492—2496).—The quantum yield of CO formation from $COEt_2$ for the region 1850—2000 A. (obtained through focal isolation of the Al spark) is 0·82 at 38 mm. $COEt_2$ and tends to unity as the pressure is lowered. Comparison of the quantum yields of CO formation at 3000 A. for $COMe_2$ (A., 1936, 1215) and COMeEt (A., 1938, I, 632) with the data on $COEt_2$ indicates either a high intrinsic instability of Pr radicals, or reactions involving them which lead to CO. In the near ultra-violet COMeEt probably dissociates almost entirely to Et and COMe radicals, whilst at short $\lambda\lambda$ Me and Et radicals are produced in approx. equal amounts. Et radicals combine to give C_4H_{10}, but a small fraction yield C_2H_6 and C_2H_4.   W. R. A.

Photosynthesis of carbohydrates from hydrated carbon dioxide. E. C. C. Baly (Proc. Roy. Soc., 1939, A, **172**, 445—465).—Experiments show that when a surface of NiO containing ThO_2 adsorbed on kieselguhr is irradiated in the presence of hydrated CO_2 an org. compound is formed. The first product of photosynthesis is unstable and changes to a stable compound which can be hydrolysed to a reducing sugar and is thought to be a type of starch.   G. D. P.

Influence of desensitisers on the decomposition of activine by light. J. Milbauer (Congr. int. Phot. sci. appl., 1936, **9**, 294—296; Chem. Zentr., 1937, i, 2574).—Many desensitisers, including Nile- and Capri-blue, brilliant- and pinacryptol-green, phenosafranine, and fuchsin, inhibit photochemical decomp. of MeOH solutions of activine.   A. J. E. W.

Photochemical reaction of fluorescent dyes. G. L. Natanson (J. Phys. Chem. Russ., 1939, **13**, 552).—On exposure to visible light of gas-free aq. solutions of uranin, eosin, and erythrosin the absorption spectra change and the fluorescence almost disappears; the final products of the change are the same as those observed by Wood (A., 1922, ii, 334). The fading of the final photo-product in presence of air is much slower than that of the original dye.   R. C.

Radiochemical polymerisation of acetylene. W. Mund, C. Velghe, C. Devos, and M. Vanpee (Bull. Soc. chim. Belg., 1939, **48**, 269—282).—Over temp. and pressure ranges 0—100° and 150—750 mm. Hg the ionic yield in the radiochemical polymerisation of C_2H_2 is ~23. Formulæ which satisfactorily account for the influence of He, N_2, and CO_2 on the course of the reaction have been derived. More C_6H_6

is formed than in the photochemical polymerisation of C_2H_2.   C. R. H.

Fractionation of the hydrogen isotopes in the distillation of ethyl alcohol. A. H. Widiger and W. G. Brown (J. Amer. Chem. Soc., 1939, **61**, 2453—2454).—During fractional distillation of ethyl alcohol isotopic separation into EtOH and EtOD occurs to an extent comparable with the separation of H_2O and D_2O in the fractional distillation of water.   W. R. A.

Formation of hydrogen peroxide during corrosion reactions. J. R. Churchill (Trans. Electrochem. Soc., 1939, **76**, Preprint 7, 77—91).—H_2O_2 is frequently formed during the corrosion of Al, Zn, Mg, and Cd in the presence of H_2O and O_2. The darkening of photographic plates in close proximity to a metal surface (Russell effect) is observed only with freshly abraded surfaces which are subject to slow oxidation and has been shown to be due to the formation of H_2O_2 which passes to the plate in vapour form. H_2O_2 can be detected when freshly abraded Al is exposed to an atm. containing only minute traces of O_2 and H_2O. In aq. media, however, a copious supply of O_2 is necessary. The formation of H_2O_2 on an Al surface is promoted by making the metal cathodic and is suppressed by making it anodic. Hence it is probably due to the oxidation of H atoms by mol. O_2. Consequently, when the rate of attack on the metal is great relatively to the O_2 supply, most of the H_2O_2 is removed by reaction with the excess of at. H, and is not detectable.   J. W. S.

Reduction of metal oxides in liquid ammonia. I. G. W. Watt and W. C. Fernelius (J. Amer. Chem. Soc., 1939, **61**, 2502—2504).—A study of the action on certain metal oxides in liquid NH_3 solutions of K has shown that (i) CuO is largely reduced to Cu_2O, (ii) Cu_2O is partly reduced to Cu, (iii) Ag_2O and Bi_2O_3 are reduced quantitatively to Ag and Bi, and (iv) GeO_2 is not reduced. The primary reaction in the reductions, the removal of O_2, is followed by ammonolysis of the K_2O to KOH and KNH_2. GeO_2 is not acted on by a liquid NH_3 solution of KNH_2 at room temp.   W. R. A.

Formation of protective oxide films on metals. N. F. Mott (Trans. Faraday Soc., 1939, **35**, 1175—1177).—Theoretical. The type of oxidation observed with (e.g.) Al, which follows the usual parabolic law up to a limiting (small) thickness of oxide and then ceases completely, may be accounted for by supposing that in such cases ions may pass from metal to oxide, but no electrons can be excited sufficiently to enter the conduction band of the oxide. A sufficiently thin film may then still grow, at a rate determined by the diffusion of the ions, owing to quantum-mechanical tunnelling of electrons. The limiting thickness is shown to be of the observed order of magnitude.   F. J. G.

Isolation of an aluminium carbonate. (Mme.) O. Grosdenis and R. Fritz (Compt. rend., 1939, **209**, 313—314).—Double *salts* varying in composition from $0·5K_2CO_3, Al_2O_3, CO_2, 5H_2O$ to $2·5K_2CO_3, Al_2O_3, 2·5CO_2, 5H_2O$ have been prepared by pptn. from oppositely directed sprays of aq. AlI_3 and

K_2CO_3 (460 and 235 g. per l., respectively), followed by washing with EtOH; the stability of these salts increases with the proportion of K_2CO_3. Treatment of the products with $(CH_2 \cdot OH)_2$ removes part of the K_2CO_3, giving the *compound* $K_2CO_3, Al_2O_3, 2 \cdot 5CO_2, 4H_2O$, which loses CO_2 at $\not< 120$—$130°$, and is probably derived from $K_2CO_3, Al_2(CO_3)_3, 5H_2O$ by slight hydrolysis. Similar experiments with EtOH solutions of AlI_3 afford oxyiodides (*e.g.*, $AlI_3, 6Al_2O_3$). A. J. E. W.

Salts of europium. H. N. McCoy (J. Amer. Chem. Soc., 1939, **61**, 2455—2456).—Prep. of *Eu*III salts of the following acids is described : HCO_2H, AcOH, $EtCO_2H$, $CH_2Cl \cdot CO_2H$, $CCl_3 \cdot CO_2H$, furoic, picric, $p\text{-}C_6H_4Me \cdot SO_3H$, $m\text{-}NO_2 \cdot C_6H_4 \cdot SO_3H$ (by dissolving Eu_2O_3 in a hot aq. solution of the acid; these salts are more sol. in hot than in cold H_2O); maleic and fumaric [from the Na salt of the acid and either $Eu(NO_3)_3$ or $Eu(OAc)_3$], malonic, succinic, tartaric, pyruvic, citric, benzoic, salicylic, cinnamic, benzilic, sulphurous [from $Eu(OAc)_3$ and the acid]. All these salts are sparingly sol. in H_2O. The Eu was determined as Eu_2O_3 and analyses of all these salts are given. EuIII salts of $HClO_4$, $CHCl_2 \cdot CO_2H$, HBr, and $NH_2 \cdot SO_3H$ are highly deliquescent. Several EuII salts have been prepared; they are very readily oxidised in air, more particularly if they are very sol. in H_2O. The slowness of the reaction between $EuSO_4$ and $KMnO_4$ is diminished by adding $Fe_2(SO_4)_3$ before titration. This also enhances the accuracy and is applicable to other EuII salts. W. R. A.

Phosphonitrile chlorides and their derivatives. A. M. DE FICQUELMONT (Ann. Chim., 1939, [xi], **12**, 169—280).—A detailed account of work already noted (A., 1935, 592; 1936, 566, 690; 1937, I, 226, 321). The following *NH4* and *Na tetrametaphosphimates* are described : $(NH_4)_4H_4P_4N_4O_8$; $Na_2H_6P_4N_4O_8, 2H_2O$, $Na_2H_6P_4N_4O_8, 2H_2O$, $Na_4H_4P_4N_4O_8, 2H_2O$. The product of ammonolysis of $(PNCl_2)_3$ (I) is $P_3N_3Cl_4(NH_2)_2$ (II) and not $P_2N_2Cl_3NH_2$ (cf. A., 1895, ii, 217; 1908, ii, 583); its m.p. is 163—$165°$. Data on the solubilities of (I), (II), and $(PNCl_2)_4$ (III) in a no. of org. solvents are given. (II) decomposes at $> 150°$, leaving an inert, amorphous *residue* (IV) and affording a sublimate containing two *substances*, α, monoclinic or triclinic, and β, orthorhombic. These also result from the action of HCl on (II) and are probably secondary products. At 180—$200°$ the sublimate also contains the *monoamine* $P_3N_3Cl_5NH_2$ (V). On continued heating (IV) gradually loses HCl, tending towards the composition P_3N_5. (V) has m.p. $> 140°$, is readily sol. in org. solvents, is hydrolysed by H_2O, and with NH_3 it re-forms (II). Equilibrium diagrams are given for a no. of the binary systems formed by (I), (III), and their NH_2-derivatives. The constitution of the phosphonitrile chlorides is discussed. The chemical evidence indicates that the Cl is all directly bound to P, and that there are no N–N or P–P linkings, so that the structure consists of open or closed chains of the type $\cdot PCl_2 \cdot N \cdot PCl_2 \cdot N \cdot$. The lower members are probably cyclic, and their polymerisation to " inorg. rubber " would involve opening of the ring followed by formation of long-chain polymerides. Theoretical considerations involving valency

angles and at. radii are used for a further elucidation of the structure. A cyclic structure for a dimeric $(PNCl_2)_2$ would involve great deformation, and accordingly polymerisation and not ring-closing would occur, corresponding with the fact that a dimeride is unknown. For (I) a stable structure is possible with the P and N atoms arranged in a plane hexagon, and this, with the position of the Cl atoms, is illustrated by a model. The structure postulated would lead to a crystal structure in agreement with the findings of Jaeger and Beintema (A., 1933, 116). F. J. G.

Concentration of heavy isotope of oxygen by distillation of water, and isotopic analysis of water. A. I. BRODSKI and O. K. SKARRE (J. Phys. Chem. Russ., 1939, **13**, 451—463; cf. A., 1938, I, 641).—By fractionation under reduced pressure the $[^{18}O]$ in H_2O has been doubled, and [D] increased 9 times. The isotopic analysis of H_2O by determinations of n and ρ is described. R. C.

Polynuclear complex chromioxalates. G. SPACU and M. VANCEA (Bul. Soc. Şţiinţe Cluj, 1936, **8**, 335—347; Chem. Zentr., 1937, i, 1905—1906; cf. A., 1936, 948).—The following *salts*, obtained by double decomp. from $(NH_4)_4A$

$$\left\{ A = \left[(C_2O_4)_2Cr{<}^{OH}_{OH}{>}Cr(C_2O_4)_2 \right]'''' \right\}, \text{ are described :}$$

$[Co\ en_2Cl_2]_4A, 9H_2O$, $[Co(NH_3)_5Cl]_2A, 6H_2O$, $[Co(NH_3)_5NO_2]_2A, 7H_2O$, $[Co(NH_3)_6]_4A_3, 22H_2O$, $[Co\ en_2]_2A, 4H_2O$, $[Co(NH_3)_5CO_3]Na_3A, H_2O$, $[Co(NH_3)_5SCN]_2A, 7H_2O$, $[Co(NH_3)_5Br]_2A, 8H_2O$, $[Co[Co\ en_2(OH)_2]_3]_2A_3, 26H_2O$, $[Co(NH_3)_5NO_3]_2A, 6H_2O$. A. J. E. W.

Salts of heteropoly-acids. I. Structure of phospho- and arseno-decamolybdates and of phospho- and arseno-decatungstates of ammonium, potassium, and thallium. A. FERRARI and O. NANNI (Gazzetta, 1939, **69**, 301—314).—X-Ray data for the following compounds are recorded : $(NH_4)_3PO_4, 12MoO_3, 4H_2O$; $(NH_4)_3AsO_4, 12MoO_3, 4H_2O$; $(NH_4)_3PO_4, 12WO_3, 4H_2O$; $(NH_4)_3AsO_4, 12WO_3, 4H_2O$; and the corresponding K and Tl salts. The results show that the H_2O in these salts is of a zeolitic nature. The prep. of the salts is described. O. J. W.

Hydrates of manganous sulphate. J. PERREU (Compt. rend., 1939, **209**, 311—313; cf. A., 1939, I, 533).—Heat of dissolution (q) measurements on the supposed two series of hydrates (cf. de Forcrand, A., 1914, ii, 659) are repeated. The non-existence of di- and tri-hydrates, and the formation of two isomeric monohydrates ($-q = 7 \cdot 61$ and $13 \cdot 75$ g.-cal. per g.-mol. for series I and II, respectively), are confirmed by these measurements and by X-radiograms [BASSIÈRE]. χ determinations confirm the isomerism. $MnSO_4, 4H_2O$ is common to both series, and the anhyd. salt occurs in series I. A. J. E. W.

Manganic sulphate. Decomposition by rise of temperature ; solubility ; hydration. L. DOMANGE (Bull. Soc. chim., 1939, [v], **6**, 1452—1459).—The decomp. of $Mn_2(SO_4)_3$ begins at $300°$ and is irreversible. It is rapid at $320°$. The solubility at $16°$ in aq. H_2SO_4 has been determined. The curve has a sharp break at $75 \cdot 2\%$ H_2SO_4 corresponding with the transition from $Mn_2(SO_4)_3$ to

$Mn_2(SO_4)_3, H_2SO_4, 6H_2O$, the brown hexagonal hydrated acid salt hitherto formulated with 4 or $8H_2O$.

F. J. G.

Ammines with thiolbenzthiazole.—See A., 1939, II, 488.

Decomposition of ferrous oxide and its solid solutions. J. BÉNARD (Ann. Chim., 1939, [xi], **12**, 5—92).—The decomp. of FeO and of its solid solutions with the oxides of other bivalent metals has been studied by means of X-rays and magnetic measurements. The prep. of very pure FeO, by reduction of Fe_2O_3 at 900° in an atm. of $CO + CO_2$, followed by rapid chilling, is described. Specimens having χ only 110×10^{-6} were obtained. The variations in the properties of FeO as usually prepared are due to the formation of solid solutions with $\not> 2\%$ Fe at 580° and $\not> 5\%$ Fe at 1000°. Solid solutions with Fe_3O_4 are not formed. Pure FeO has a 4·282 A. The decomp. may be followed continuously by magnetic measurements. Below 450° it is apparently of the eighth order in the early stages, owing to the formation of metastable solid solutions with, at 350°, $\not> 19$ g. Fe per 100 g. FeO, i.e., approx. $4FeO + Fe$, so that the equation is $8FeO = Fe_3O_4 + (4FeO + Fe)$. At higher temp. the reaction corresponds with $4FeO = Fe_3O_4 + Fe$. The rate of decomp. becomes appreciable at 300°, rises to a max. at ~500°, and falls to zero at 570°. FeO and CoO form a complete range of solid solutions, which are less stable than FeO, the transition temp. rising to a max. at 890° with the composition $3FeO + CoO$. Their decomp. affords $Fe_3O_4 + Co$. Solid solutions with NiO behave similarly, but are still more unstable, whilst solid solutions with MnO and MgO are more stable than FeO. In the decomp. of all these solid solutions " mixed ferrites " (cf. A., 1937, I, 259) are formed. Lattice consts. and Curie points are recorded for these, and also for the cubical solid solutions of Fe_2O_3 with $M^{II}O$ to which they give rise on oxidation.

F. J. G.

Action of nitric acid on iron carbide. J. VAUTHRIN (Compt. rend., 1939, **208**, 1154—1156, and Bull. Soc. chim., 1939, [v], **6**, 1420—1425).—The brown substance formed by the action of HNO_3 on cast Fe has been isolated by using excess of Fe in such a way that a surface coating is formed, and extracting this with NaOH. The substance is peptised by alkalis and flocculated by dil. acids. In composition and behaviour it resembles the products obtained by the action of HNO_3 on various forms of amorphous C. The relationship between these substances and graphitic oxide and humic acid is discussed.

F. J. G.

Stereochemistry of complex inorganic compounds. IV. Introduction of racemic organic molecules into some optically active complex ions of cobalt and chromium. J. C. BAILAR, jun., C. A. STIEGMAN, J. H. BALTHIS, jun., and E. F. HUFFMAN (J. Amer. Chem. Soc., 1939, **61**, 2402—2404).—An improved method of preparing $[Co(l\text{-}pn)_2Cl_2]Cl$ (I) is given (pn=propylenediamine). The reactions between dl-pn and $[Co(l\text{-}pn)_2X_2]X$ (X = Cl, NO_2, CO_3) at various temp. and concn. take place completely according to $2[Co(l\text{-}pn)_2X_2]X + dl\text{-}pn \rightarrow$

$[Co(l\text{-}pn)_3]X_3 + [Co(l\text{-}pn)_2(d\text{-}pn)]X_3$ and both antipodes of the base act with the same readiness. Similarly both d- and l-alanine react with (I) to give $[Co(l\text{-}pn)_2\text{alanine}]Cl_2$, and, although several stereoisomerides are possible they could not be separated because of their very high solubility. An attempt to separate the mirror-image stereoisomerides of the complex formed between leucine and $[Co \, en_2Cl_2]Cl$ was also frustrated by the high solubility of the stereoisomerides. In the reaction of phenylalanine (II) (pa) with luteochromic salts the diamine mols. are completely expelled from the complex : $[CrA_3]I_3 + (II) \rightarrow$

$$\left[(pa)_2Cr\!\!<^{OH}_{OH}\!\!>Cr(pa)_2\right] (III) + 3A,HI. \text{ (III) is insol.}$$

in hot and cold H_2O and in the usual org. solvents; it is not optically active. Because of its insolubility (III) might be utilised in separating (II) from other NH_2-acids.

W. R. A.

cis–trans-Interconversion amongst co-ordination compounds. I. Investigation of the isomeric dichlorobisethylenediaminocobaltic chlorides by means of a radioactive isotope of chlorine. G. W. ETTLE and C. H. JOHNSON (J.C.S., 1939, 1490—1496).—No direct exchange occurs in solution between radioactive Cl' and co-ordinatively bound Cl in the complex ions 1 : 2- and 1 : 6-$[Co \, en_2Cl_2]\text{'}(I)$ and 1 : 2-$[Co \, en_2(H_2O)Cl]\text{''}$. During the isomeric changes 1 : 2-(I) $\rightleftharpoons$ 1 : 6-(I) complete random redistribution of all the Cl occurs, as under the conditions the aquotisation equilibria 1 : 2- or 1 : 6-(I) $\rightleftharpoons$ $[Co \, en_2(H_2O)Cl]\text{''} +$ Cl' $\rightleftharpoons$ $[Co \, en_2(H_2O)_2]\text{'''} + 2Cl'$ are rapidly set up. At room temp. no direct intramol. rearrangement of co-ordinatively bound Cl occurs. The relative amounts of the two isomerides of (I) obtained on evaporation alone or with HCl appear to be governed largely by solubility considerations, the cis-salt being the less sol., but the $trans$-salt separating from HCl solution as a sparingly sol. additive compound. F. J. G.

Standardisation of acidimetric solutions. R. L. VANDAVEER (J. Assoc. Off. Agric. Chem., 1939, **22**, 563—567).—The borax and Na_2CO_3 methods are recommended for tentative adoption; the AgCl method is rejected. E. C. S.

Boric acid as a titrimetric standard. H. T. LIEM (Pharm. Tijds. Nederl.-Ind., 1936, **13**, 291—296; Chem. Zentr., 1937, i, 2817).—Commercial H_3BO_3, once recryst. from boiling H_2O, is sufficiently pure for use as a standard, titration being carried out in presence of excess of glycerol, mannitol, fructose, or invert sugar. A. J. E. W.

Thallous carbonate as an acidimetric standard. E. JENSEN and B. NILSSEN (Ind. Eng. Chem. [Anal.], 1939, **11**, 508; cf. A., 1939, I, 156).—Tl_2CO_3 must be recryst. in Pt and not in glass vessels. Tests to establish the absence (<0·01%) of Mg, Ca, Ba, Al, Fe, Mn, Pb, Ag, Hg, K, Na, Cl, NO_3, and SO_4 in a sample are described. Tl_2CO_3 is stable up to $\not< 150°$, non-hygroscopic up to 80% R.H., and does not absorb CO_2 from the atm. Bromocresol-purple is a suitable indicator, giving a sharp end-point in boiling solution. Results obtained by standardising HCl gravimetrically and against Na_2CO_3 agree with those using Tl_2CO_3. The latter method gives the closest

agreement among individual determinations of a series. L. S. T.

Patent-blue V as a p_H and redox indicator. J. H. YOE and G. R. BOYD jun. (Ind. Eng. Chem. [Anal.], 1939, **11**, 492—493).—An aq. solution of patent-blue V (I) can be used for the colorimetric determination of p_H over the range 0·8—3·0 (yellow → green → blue). The colours are stable for 5 days, after which very slight fading can be detected. (I) can also be used in the titration of Fe·· with $KMnO_4$ or $Ce(SO_4)_2$, but not with $K_2Cr_2O_7$, or in presence of HCl. The oxidation–reduction potential of the indicator is 0·78 v. L. S. T.

Determination of water in bleaching powders. —See B., 1939, 1035.

Fischer's method for titrimetric determination of water.—See B., 1939, 1020.

Analytical procedures employing Karl Fischer reagent. I. Nature of the reagent. D. M. SMITH, W. M. D. BRYANT, and J. MITCHELL, jun. (J. Amer. Chem. Soc., 1939, **61**, 2407—2412).—The Fischer method for the determination of H_2O in a material involves a direct titration of the wet substance with a solution of I, SO_2, and C_5H_5N in MeOH, the reagent serving as its own indicator (B., 1935, 785). The reagent is considered to be a mixture of the two binary compounds $C_5H_5NI_2$ and $C_5H_5NSO_2$ which have been identified by optical crystallographic methods. The deterioration of Fischer's reagent on keeping has been investigated. After one month pronounced disappearance of C_5H_5N and total acidity was observed. Side reactions are indicated, but no method of inhibition has been devised. The effect of substituting other amines (quinoline, NH_2Ph, $NPhMe_2$, NBu^a_3, NEt_3 with C_5H_5N as control) in solvents other than MeOH (C_6H_6, dioxan, glacial AcOH, EtOH, MeCN, $HCO·NMe_2$, C_5H_5N) has been investigated. W. R. A.

Evaluation of hydrogen peroxide.—See B., 1939, 1035.

Systematic analysis of the common anions. T. P. CHAO (J. Chem. Educ., 1939, **16**, 376—380).— The detailed procedures described are based on the differing solubilities of the Ca, Ba, Ni, and Ag salts. L. S. T.

[Standardisation of] iodine and thiosulphate solutions. K. L. MILSTEAD (J. Assoc. Off. Agric. Chem., 1939, **22**, 567—571).—The method outlined in the certificate accompanying U.S. Bureau of Standards sample No. 83 of As_2O_3 for the standardisation of 0·1N-I is detailed and recommended for tentative adoption. Results obtained during tests of the standardisation of $Na_2S_2O_3$ against aq. I and aq. KIO_3 are tabulated. Errors in the second method are attributed to the presence in KIO_3 of $NaIO_3$ as an impurity. E. C. S.

[Examination of] waters, brine, and salt. Fluorine in water. A. E. MIX (J. Assoc. Off. Agric. Chem., 1939, **22**, 482—486).—Strict adherence to the A.O.A.C. procedure is necessary if accurate results are to be obtained by the $Th(NO_3)_4$ method. $HClO_4$, not H_3PO_4, must be used for the distillation;

the aliquot after neutralisation must be evaporated to ≯20 c.c. before liberation of HF; exactly 2 c.c. of free aq. HCl (1 in 250) must be present in the solution at titration; and for colour comparison to be valid, standard and unknown must have the same amount of $Th(NO_3)_4$ in the same vol. of liquid. E. C. S.

Determination of fluorine.—See B., 1939, 1061.

Titration of sulphides with potassium ferricyanide : (1) potentiometrically ; (2) using ferrous dimethylglyoxime as redox indicator. G. CHARLOT (Bull. Soc. chim., 1939, [v], **6**, 1447—1451).—S″ can be accurately titrated with $Fe(CN)_6′″$ using potentiometric indication or Fe^{II} dimethylglyoxime as indicator, in presence of an NH_3–NH_4Cl buffer. $S_2O_3″$ does not interfere; $SO_3″$ may be removed by pptn. with $BaCl_2$. F. J. G.

Detection of hydrogen sulphide.—See B., 1939, 1078.

Determination of nitrogen in fertilisers.— See B., 1939, 1062.

Determination of phosphoric acid in basic slag and superphosphate.—See B., 1939, 1035.

Determination of phosphoric acid in fertilisers. —See B., 1939, 1062.

Volumetric determination of small amounts of arsenic. J. H. KŘEPELKA and B. RAKUŠAN (III Kongr. slovensk. Apt. Jugoslav., 1935, 186—198; Chem. Zentr., 1937, i, 2415).—0·0008—0·28 g. of As_2O_3 may be determined by leading the resulting AsH_3 into 0·1N-I, which is titrated back with 0·1N-$Na_2S_2O_3$ in slightly acid solution. A. J. E. W.

Determination of arsenic by continuous electrolytic method. H. C. LOCKWOOD (Analyst, 1939, **64**, 657—666).—The arsenical solution flows slowly over a Cd cathode, the Pt anode being separated by a glass wool plug. The apparatus is cooled in a trough of water, and will take 2 amp. from the mains supply, the p.d. between the electrodes being ~15 v. Drying the gas and deposition of As are described and the apparatus is figured. The prep. of test solutions is detailed. E. C. S.

Determination of carbon disulphide.—See B., 1939, 1020.

Determination of potash in fertilisers.—See B., 1939, 1062.

Rapid determination of potassium minerals in Kałusz potassium deposits.—See B., 1939, 1035.

Determination of small amounts of dissolved solids in water.—See B., 1939, 1007.

Colorimetric determination of barium. H. A. FREDIANI and B. J. BABLER (Ind. Eng. Chem. [Anal.], 1939, **11**, 487—489).—Ba·· is pptd. as $BaCrO_4$ in AcOH–NH_4OAc solution by aq. $(NH_4)_2CrO_4$. After digestion, filtration, and washing, the ppt. is dissolved in cold, dil. HCl or HNO_3, diluted, and compared against standard solutions in a Klett colorimeter. The solution for comparison should contain from 0·2 to 1 mg. of Ba·· per ml. Equiv. amounts of Na·, K·, Ca··, and Mg·· are without effect.

The high results obtained in presence of $Sr^{..}$ can be eliminated by double pptn. This is best effected by dissolution of the impure chromate ppt. in HCl, neutralisation with aq. NH_3, boiling, and adding aq. NH_4OAc. L. S. T.

Polarographic determination of zinc oxide in lithopone.—See B., 1939, 1055.

Quantitative spectrographic analysis of solder, spelter, magnesium, and aluminium alloys. —See B., 1939, 1049.

Internal electrolysis as a method of analysis. B. L. CLARKE and L. A. WOOTEN (Trans. Electrochem. Soc., 1939, **76**, Preprint 27, 339—348; cf. B., 1937, 176).—Methods of internal electrolysis, in which two different metals introduced into the same solution and connected externally supply the e.m.f. required for electrodepositions, are reviewed. The application of this principle to the determination of Cd and Cu in Zn alloys and of Sn in Al alloys is described. J. W. S.

Determination of thallous sulphate in ant poisons.—See B., 1939, 1078.

Detection of small traces of copper using the antimony electrode. G. A. PERLEY (Trans. Electrochem. Soc., 1939, **76**, Preprint 12, 141—146).—The presence of 0·1—0·5 p.p.m. of $Cu^{..}$ may be detected in solutions of p_H 2—8 by an electrochemical colorimetric method. An Sb electrode is introduced into the solution being tested, the trace of Cu being deposited on the Sb by displacement. The Cu-coated end of the electrode is then placed on a filter-paper, wetted with 2 drops of 25% $NaNO_2$ solution and 1 drop of 0·1% solution of $NEt_2 \cdot CS_2Na$, supported on a Ni plate as cathode. A current of 20 ma. is applied; Cu dissolves, producing a brown stain on the filter-paper which is compared with a set of standard stains. F. H.

Electrolytic assay. G. L. JONES (Ind. Eng. Chem. [Anal.], 1939, **11**, 461).—The use of a permanent magnet to produce agitation of the electrolyte is described. In H_2SO_4, but not HNO_3 solution, good and complete deposition of Cu is obtained in 90 min. The stirring effect is too weak at low c.d. L. S. T.

Gravimetric determination of aluminium. G. FLAMIANI and M. FERRICH (III Kongr. slovensk. Apt. Jugoslav., 1935, 160—169; Chem. Zentr., 1937, i, 2415).—Al_2O_3 is obtained free from other oxides by the following process: the $AlCl_3$ solution is added to 75 c.c. of H_2O containing 5 g. of NH_4NO_3, to which a few c.c. of aq. NH_3 (freshly distilled if Mg, Ba, etc. are present) have been added, at 80—90°; the ppt. is kept for 20 min. at 60°, collected, washed with 0·2—0·3% NH_4NO_3, and ignited for 10 min. at 1100—1200° after burning off the paper. A. J. E. W.

Determination of aluminium by precipitation with 8-hydroxyquinoline from mineral acid solution; separation from large amounts of magnesium. G. S. SMITH (Analyst, 1939, **64**, 577—581).—p_H is stabilised by addition of $KBrO_3$, KBr, and $Na_2S_2O_3$, in order to prevent pptn. of the Mg complex at p_H >7. An improved method of

pptn. of the Al complex free from Mg is described. Details of the subsequent titration of the pptd. hydroxyquinoline with 0·1N-BrO_3'–Br are given. The method is satisfactory for 0·5—10·0 mg. of Al. E. C. S.

Determination of manganese, especially in biological material. F. E. READ (Analyst, 1939, **64**, 586—587).—0·1—1·0 mg. of Mn is determined photoelectrically by the KIO_4 method, using the Hilger Spekker Absorptiometer. 10—30 mg. are determined by a modification of Willard and Thompson's volumetric method (cf. A., 1931, 1385). E. C. S.

Photo-electric colorimetry. Optical study of permanganate ion and of the chromium–diphenylcarbazide system. G. P. ROWLAND, jun. (Ind. Eng. Chem. [Anal.], 1939, **11**, 442—445).—The periodate method for the colorimetric determination of Mn and the diphenylcarbazide method for Cr_2O_7'' have been investigated photo-electrically. In the former method optical separation of interfering ions is effected by removal of the colour due to MnO_4' with a few drops of H_2O_2 or a few mg. of NaN_3, and using this solution to obtain the 100% transmission val. L. S. T.

Electro-analytical determination of rhenium. O. TOMÍČEK and F. TOMÍČEK (Trans. Electrochem. Soc., 1939, **76**, Preprint 16, 197—203).—Determination of ReO_4'' by cathodic reduction in H_2SO_4 gives results 2·5% high owing to contamination of Re on the Pt cathode with oxides. Re may be determined accurately by oxidising to $HReO_4$ and electrolysing in 5% H_2SO_4 (using 1—20 mg. of ReO_4'') at 70° for 3 hr. using a Pt-gauze anode and Pt-wire cathode, c.d. 0·25 amp. per sq. dm. and 2·34 v. Re in the cathode deposit is determined by oxidising with 10% H_2O_2 of known acidity and titration of the resulting $HReO_4$ by 0·01N-NaOH using Me-red or bromocresol-purple as indicator. 1 ml. 0·01N-NaOH $\equiv$ 1·863 mg. Re. F. H.

Hydrogen peroxide in the colorimetric determination of iron by thiocyanate. C. A. PETERS, M. M. MACMASTERS, and C. L. FRENCH (Ind. Eng. Chem. [Anal.], 1939, **11**, 502—503).—H_2O_2 is a better oxidising agent than $KMnO_4$ since the red colour of the $Fe(CNS)_3$ is then more stable, and a faded colour can be restored by addition of more H_2O_2. Introduction of the deleterious SO_4'' is also avoided. Too much H_2O_2 may produce interference from a yellow colour due to oxidation products of CNS'. Data relating to the production of colour in solutions containing different [CNS'], [H_2O_2], and [HCl], and curves showing the rate of fading of $Fe(CNS)_3$ are reproduced. L. S. T.

Colorimetric determination of iron and lead, using the Lovibond nessleriser. ANON. (Int. Sugar J., 1939, **41**, 393—394).—For Fe^{II} and Fe^{III} the method used is to match the reddish colour produced by its reaction with thioglycollic acid in presence of NH_4 citrate. For Pb the colour reaction is produced by addition of Na_2S to ammoniacal solutions containing it, interfering metals being pre-

viously isolated by the Allport–Skrimshire procedure (A., 1932, 1103), using diphenylthiocarbazone.   J. P. O.

Determination of small amounts of nickel, zinc, lead, and mercury by micro-electrolysis and spectrography. C. SANNIÉ and V. POREMSKI (Bull. Soc. chim., 1939, [v], 6, 1401—1410).—The metal to be determined is deposited on an electrode of Cu wire or graphite rod, and the spectrum compared with that of known standards obtained under the same conditions. The results are good for Zn and Ni, less so for Pb, and unsatisfactory for Hg.   F. J. G.

Rapid determination of nickel in light alloys.— See B., 1939, 1050.

Polarographic determination of vanadium and chromium and polarographic titration of molybdenum in steels.—See B., 1939, 1046.

Electrolytic determination and separation of bismuth. II. Determinations in sulphuric and nitric acid solutions. F. G. KNY-JONES (Analyst, 1939, 64, 575—577; cf. A., 1939, I, 279).— In H_2SO_4, electrolysis is carried out at 100°, with Pt gauze electrodes and $(N_2H_4)_2,H_2SO_4$ as depolariser. The initial potential of the auxiliary electrode is 0·055 v. When the current falls to zero the potential is readjusted to 0·15 v. and electrolysis continued until the current again falls to zero. In HNO_3, BiOCl tends to be deposited if Cl' is present, causing poor, non-adherent films.   E. C. S.

Nichrome furnace of long life. J. G. WINANS and S. W. CRAM (Rev. Sci. Instr., 1939, 10, 272).— Provision of an air space between the asbestos and nichrome wire increases the life of the wire four-fold.   D. F. R.

Simple electrical apparatus for heating single crucibles. A. HAYNES and R. A. McCANCE (Analyst, 1939, 64, 584—586).   E. C. S.

Chemical heater. W. MASTER (Ind. Eng. Chem. [Anal.], 1939, 11, 452).—The new type of electrical heater described can be used as an ordinary hot plate or, when provided with a removable heat-reflecting jacket, as an air-bath. In the latter form it provides a substitute for liquid baths, and, by use of a double jacket, temp. can be controlled to <1°. The apparatus is rugged and eliminates corrosion.   L. S. T.

Radio-electric relay for thermo-regulators. A. L. DELAUNOIS (J. Physiol., 1939, 96, 58—60P).   J. A. C.

Thermo-regulator. G. H. BURROWS (J. Chem. Educ., 1939, 16, 278).—The Hg-in-glass thermo-regulator described avoids the need of sealing Pt into glass. The make-and-break contact wires are of Ni–Cr or Pt, and the glass stopcock is lubricated with flake graphite instead of grease. When the regulator is in use and the stopcock closed, the graphite completes the circuit. In the purification of Hg in the usual Victor Meyer apparatus, a short column of CCl_4 between the aq. $HgNO_3$ and the Hg prevents clogging on long keeping through the formation of a basic nitrate.   L. S. T.

Temperature control systems.—See B., 1939, 1007.

Thermometers and automatic temperature controllers.—See B., 1939, 1007.

Thermometer guard. M. B. STANDING and J. H. WIEGAND (Ind. Eng. Chem. [Anal.], 1939, 11, 462).   L. S. T.

Adiabatic high-temperature calorimeter for the determination of heat changes occurring during alloy formation. O. KUBASCHEWSKI and A. WALTER (Z. Elektrochem., 1939, 45, 630—636).— A calorimeter which can be used at $>700°$ is described. The probable errors involved in determination of heats of reaction at $\sim600°$ are discussed.   J. W. S.

Calorimeter. R. LIVINGSTON and W. HORWITZ (J. Chem. Educ., 1939, 16, 287—290).—A portable calorimeter is described.   L. S. T.

Electric m.p. micro-apparatus. R. E. DUNBAR (Ind. Eng. Chem. [Anal.], 1939, 11, 516—517).— A cylindrical Al block, carrying a thermometer, is heated electrically by resistance wire, and the behaviour of a crystal on heating is observed after illumination by a light placed below a hole in the centre of the block.   L. S. T.

Expansion liquefier for helium. A. H. COOKE, B. V. ROLLIN, and F. SIMON (Rev. Sci. Instr., 1939, 10, 251—253).—The steel expansion chamber is of 450 c.c. capacity and is provided with an outlet valve opening at a low temp. for the passage of liquid He. In one expansion 200 c.c. of liquid He may be obtained with a consumption of 700 c.c. of liquid H_2 and 5000 c.c. of liquid air.   D. F. R.

Adapting miniature cameras to petrographic photomicrography. P. S. DEAR (J. Amer. Ceram. Soc., 1939, 22, 279—281).—Details are given of a simple design particularly suitable for petrography. Examples of its application to ceramic technology are recorded.   J. A. S.

Use of selenium photo-electric cells for precision photometry. J. TERRIEN (Compt. rend., 1939, 209, 300—301).—The effect of sensitivity changes with time, temp. etc. is eliminated by matching all intensities (by adjustment of distances) to that of a common " tare " lamp, for which readings are taken at frequent intervals (2—4 sec.). Results for incandescence lamps, using selected cells, are independent of colour temp. at 2045—2360° K.   A. J. E. W.

Potassium iodide method of measuring solar radiations. G. H. WALKER (Analyst, 1939, 64, 592—594).—Quartz, window-glass, and " daylight " glass cut off little of the active radiation, Chance–Parsons blue-green, ultra-violet, and purple filters transmit a considerable proportion of it, but light and dark orange, ruby, and red filters cut off >90%.   E. C. S.

Rotation factor for equi-inclination Weissenberg photographs. G. TUNELL (Amer. Min., 1939, 24, 448—451).—Vals. of the rotation factor are plotted.   L. S. T.

Quantitative measurement of dichroism in tourmaline. C. B. SLAWSON and N. W. THIBAULT (Amer. Min., 1939, 24, 492—498).—A direct method is described.   L. S. T.

Photography of chemiluminescence. E. W. COTTMAN (J. Chem. Educ., 1939, **16**, 292—294).— The conditions required for photographing chemiluminescence are described.　　　L. S. T.

Temperature corrections in optical pyrometry. F. BENFORD (J. Opt. Soc. Amer., 1939, **29**, 162—163).—A chart of corrections for losses at the glass surfaces in brightness measurements of surfaces enclosed in glass is given for 800—4000° K.
　　　L. J. J.

Automatic recording spectroradiometer for cathodoluminescent materials. V. K. ZWORYKIN (J. Opt. Soc. Amer., 1939, **29**, 84—91).—An automatic spectrophotometer consisting of a demountable light source and an interrupter, a glass monochromator with compensation for the variation of the dispersion with λ, a photo-electric multiplier, a signal amplifier stabilised by negative feedback, and a motor amplifier controlling the deflexion of the recording head, is designed for the study of cathodoluminescent materials. It is of use with sources emitting one millilumen per sq. cm.　　　F. J. L.

Transparent and opaque screens for the near infra-red. A. H. PFUND (J. Opt. Soc. Amer., 1939, **29**, 56—58).—A saturated solution of $Fe(NH_4)_2(SO_4)_2$ has a high transmission in the visible, and is practically opaque for λ $> 1·05$ μ. Solutions of $VOSO_4$ exhibit a very strong transmission at $1·1$ μ.
　　　F. J. L.

X-Ray photography by means of fluorescence X-radiation. E. DERSHEM (J. Opt. Soc. Amer., 1939, **29**, 41—42).—Photographs of microtome sections of bone are obtained using an X-radiation which is selectively absorbed by parts of the specimen. A thin layer of Sc oxide is irradiated with X-rays of slightly higher frequency than the crit. absorption frequency for Sc. The emitted fluorescent beam has average λ 3·02 A., and is almost completely absorbed by Ca (K absorption limit 3·06 A.). Using S as a radiator detailed photographs of grasshoppers' wings are obtainable.　　　F. J. L.

Use of the hydrogen lamp in absorption spectroscopy. I. H. VON HALBAN. II. H. STÜCKLEN (J. Opt. Soc. Amer., 1939, **29**, 305).—I. The method of determination of extinction coeffs. described by Stücklen (A., 1939, I, 237) is less accurate than that of Halban (A., 1936, 1223).
　II. A reply.　　　O. D. S.

Measurement of turbidity. K. KIESER (Chem. Fabr., 1939, **12**, 334—335).—In the apparatus described, two similar photo-cells are mounted on an optical bench on opposite sides of a lamp, one cell being fixed 100 cm. from the lamp and the other being movable. Similar absorption cells, each containing the turbid liquid, are placed immediately in front of the photo-cells, and the movable cell and its absorption cell are moved until the currents from the two photocells are balanced. The absorption cell in front of the fixed photo-cell is then moved to a position 50 cm. from the latter. The movement of the second photo-cell, with its absorption cell, required to restore the balance of the currents is used as a measure of the turbidity of the solution. The results obtained are independent of the colour of the solution.
　　　J. W. S.

Ocular photo-cell for the rapid determination of projected area of opaque particles. G. T. FAUST and S. R. B. COOKE (U.S. Bur. Mines, 1939, Rept. Invest. 3460, 14 pp.).—The average projected area of a layer of the particles is determined by measurement of the amount of light cut off from a photo-electric cell.　　　F. J. G.

Objective colorimetry. A. H. W. ATEN (Chem. Weekblad, 1939, **36**, 606—607).—The basic principles of spectrophotometry and photo-electric colorimetry are discussed.　　　S. C.

New light sources for colorimetry. F. L. MATTHEWS, R. H. CRIST, and A. KNOLL (Ind. Eng. Chem. [Anal.], 1939, **11**, 503).—Two lamps, one a green fluorescence lamp and the other a Ne source, giving high-intensity illumination of relative coolness, are described. Thick filters can be used to give ∼ monochromatic light without undue loss of intensity.
　　　L. S. T.

Micro-colorimeter with selenium-film cells. H. WITZMANN (Chem. Fabr., 1939, **12**, 332—334).— The apparatus comprises two Se-film photo-cells illuminated by separate lamps connected in series. The difference between the photo-currents developed by the cells is measured with a galvanometer, and, after initial balancing of the cells, gives a direct measure of the absorption due to a column of liquid placed in front of one cell. Suitable filters are used for both cells when measuring the turbidity of coloured solutions.　　　J. W. S.

Test-tube photo-electric colorimeter, and the use of the photo-electric colorimeter in colorimetric analysis. W. H. SUMMERSON (J. Biol. Chem., 1939, **130**, 149—166).—A double photo-cell colorimeter utilising standardised interchangeable test-tubes as solution containers is described. The " reference " photo-cell is shunted through a potentiometer, whilst the " working " photo-cell is shunted through a resistance and is also connected through a galvanometer to one end and the slider of the potentiometer. Readings are taken directly on a simplified logarithmic scale which for many solutions gives scale readings which are ∝ concn. It is recommended that for accurate colorimetric analysis comparison should be made with a simultaneously prepared standard instead of utilising a calibration curve.
　　　J. W. S.

Optical set-up for measurement of bubble-window thickness. E. H. GREEN (Rev. Sci. Instr., 1939, **10**, 272).—A simple interferometric method which enables both the point-by-point and average thickness of the window to be measured is described.　　　D. F. R.

Pulse amplifier for differential electrometric titrations. H. H. BAKER, jun., and R. H. MÜLLER (Trans. Electrochem. Soc., 1939, **76**, Preprint 15, 187—196).—Differential electrometric titrations are performed by use of a pulse amplifier which responds only to changes in potential and eliminates the need for mechanical isolation of a portion of the solution

around one electrode. The circuit described allows the results to be checked by conventional technique, a simple vac.-tube voltmeter being included. The results are independent of rate of stirring above a moderate min. val. The rate of attainment of equilibrium is important but in most cases is sufficiently rapid. In titration of C_2O_4'' by $Ce(SO_4)_2$ addition of ICl as catalyst accelerates the attainment of equilibrium. The validity of the pulse method is shown by 7 examples of potentiometric titrations of the acid–base, oxidation–reduction, and pptn. types, the precision being $\sim 0.1\%$.   F. H.

Measurements with the dropping mercury electrode. G. A. PERLEY (Trans. Electrochem. Soc., 1939, **76**, Preprint 19, 225—235).—A discussion of the limitations of the method in analysis.   F. H.

Cell and dropping electrode for polarographic analysis. J. J. LINGANE and H. A. LAITINEN (Ind. Eng. Chem. [Anal.], 1939, **11**, 504—505).—The usual stationary pool of Hg is eliminated, and the reference electrode is used in its place. An apparatus combining a dropping electrode with an H-cell, in which the solution to be analysed is placed in the left half and the reference electrode (calomel or Ag–AgCl) in the right half, is described.   L. S. T.

Dipping-type conductivity cell. C. S. HOWARD (Ind. Eng. Chem. [Anal.], 1939, **11**, 511).—Steps in the manufacture of a lucite conductivity cell of the commonly-used dipping type suitable for measuring the conductivity of H_2O samples are described and illustrated.   L. S. T.

Measurement and control of p_H. N. HALL and G. B. HOGABOOM, jun. (Metal Ind., N.Y., 1939, **37**, 270—272, 317—319).—A discussion of methods.
                    L. S. T.

Apparatus for electrodialysis. J. RUSSELL and R. E. STAUFFER (Ind. Eng. Chem. [Anal.], 1939, **11**, 459).—Electrodialysis cells constructed from standard fittings of Corning industrial flanged Pyrex pipe are described and illustrated.   L. S. T.

Apparatus for production of visible electron motion in rock-salt and sylvine crystals. H. LORENZ (Zentr. Min., 1937, A, 1—9; Chem. Zentr., 1937, i, 2549).—On application of a d.c. potential of 20 v. to the crystal, heated to 600—700°, through pointed electrodes, a red (NaCl) or brown (KCl) coloration spreads from the positive pole at a rate of ~ 1 mm. per sec.   A. J. E. W.

Photo-cells in X-ray technology. R. HERZ (Fortschr. Geb. Röntgenstrahlen, 1936, **54**, 616—627; Chem. Zentr., 1937, i, 2422—2423).—Se cells are insensitive to direct illumination with X-rays, and are readily saturated, but exposure of the cell to an irradiated fluorescent screen gives satisfactory proportionality of photo-current to the X-ray intensity, without lag or fatigue. The effect of various irradiation factors on the photo-current, and the relation between photographic blackening and the photo-electrically determined fluorescent intensity, are studied, and applications are discussed.
                    A. J. E. W.

Sensitive time of a Wilson expansion chamber. E. J. WILLIAMS (Proc. Camb. Phil. Soc., 1939, **35**,

512—515).—The warming of the gas after the cooling expansion takes place through its compression by the expanding layer in contact with the walls, warmed by conduction. The sensitive time $\propto$ the density of the gas, and increases with the size of the chamber.
                    L. J. J.

Luminescence counters. G. VALLE and G. DASCOLA (Nuovo Cim., 1939, **16**, 59—77).—Two types of circuit used in luminescence counters are described and compared, and used to measure the intensity of radiation sources, especially of radioactive substances. This is the most useful application of this type of counter, but there is a limiting radiation frequency beyond which they cease to function. The mechanism of Geiger–Müller counters is also discussed.
                    O. J. W.

Construction of Geiger-Müller counters and their use in coincidence experiments. S. C. CURRAN and V. PETRŽÍLKA (Proc. Camb. Phil. Soc., 1939, **35**, 309—321).—An internally extinguished counter may be used with a resistance of 50,000 Ω. and still retain all its useful features. Various designs for internally extinguished counters are described. Brass and Cu walls are equally good if the Cu is gently heated in air so that a very thin layer of the oxide is present on the surface. For thin-walled counters of low stopping power oxidised Al walls are best. A–EtOH gas mixtures are best for general purposes, but He–EtOH gas mixture has the advantage of not becoming radioactive. The quantum energy of the hard γ-radiation is measured by the method of coincidences using a two-stage amplifying circuit with a resolving time of 10^{-6} sec.
                    F. J. L.

1000-kv. generator for production of radioactive substances. E. P. VANONI (Strahlenther., 1939, **65**, 304—314).   E. M. J.

Torsion micro-balance for the determination of specific gravities of minerals. H. BERMAN (Amer. Min., 1939, **24**, 434—440).—The balance described uses $\not> 25$ mg. of material and is accurate to 0.01 mg. PhMe or CCl_4 is used as the displacement liquid. A determination is completed in 5 min., and for a 25-mg. specimen of ρ 5 the accuracy is 1—2%. New ρ data for many minerals are tabulated.
                    L. S. T.

Methods of using the analytical balance. I. LIN (J. Chem. Educ., 1939, **16**, 340—343).—Different methods of setting the balance in motion and of calculating the rest point from a series of swings are compared.   L. S. T.

Calibration of weights. E. BLADE (Ind. Eng. Chem. [Anal.], 1939, **11**, 499—501).—A modification of Richards' method is described and the validity of the method discussed.   L. S. T.

Graduated pyknometer. G. R. ROBERTSON (Ind. Eng. Chem. [Anal.], 1939, **11**, 464).   L. S. T.

Micro-pyknometric density determination. C. J. KSANDA and H. E. MERWIN (Amer. Min., 1939, **24**, 482—484).—Improved technique is described.
                    L. S. T.

Auxiliary sliding scale for burettes. A. A. HIRSCH (Ind. Eng. Chem. [Anal.], 1939, **11**, 431).
                    L. S. T.

Short cut in gas analysis. F. S. COTTON (J. Lab. clin. Med., 1939, **24**, 1178—1183).—By special points in construction of the gas analysis apparatus the flushing of the dead spaces in routine analyses is avoided and in triple gas analyses the no. of visits to absorbing solutions is greatly reduced.   C. J. C. B.

High-efficiency distillation column for the laboratory. E. JANTZEN and W. HAKER (Chem. Fabr., 1939, **12**, 329—331).—An evaporator (capacity 10 l.) is connected to three fractionating columns arranged in series and giving a total effective length of 24 m. The columns are packed with 6-mm. Fe rings. The residue collecting at the base of each column is transferred by a pump to the head of the previous column. An example of the use of the column in the separation of PhEt and o-, m- and p-xylene is given.   J. W. S.

Vacuum arc mercury still. M. V. SIVARA-MAKRISHNAN (Indian J. Physics, 1939, **13**, 205—208). —Constructional and operational details of a vac. arc Hg still are given. Current flows through a short Hg arc and the heat generated vaporises the Hg, which is condensed by a H_2O-cooled condenser.   W. R. A.

Laboratory fractionating column. G. F. REY-LING (Ind. Eng. Chem. [Anal.], 1939, **11**, 419).—A small, hook-shaped glass tube placed at the bottom of the packed column permits the return of the condensed liquid to the flask and allows vapour to pass unhindered to the top of the column.   L. S. T.

Apparatus for determining moisture by the distillation method. A. C. BECKEL, A. G. SHARP, and R. T. MILNER (Ind. Eng. Chem. [Anal.], 1939, **11**, 425—426).—The apparatus described is superior to those of the Bidwell–Sterling type since droplets of H_2O formed on the walls of the condenser are removed automatically, and the milky suspension of H_2O in PhMe formed in the receiver is eliminated by automatic redistillation. Test data for H_2O in soya beans are recorded. A determination can be completed in <2 hr.   L. S. T.

Vacuum sublimation and molecular distillation apparatus. A. A. MORTON, J. F. MAHONEY, and G. RICHARDSON (Ind. Eng. Chem. [Anal.], 1939, **11**, 460—461).—An apparatus for the vac. distillation of solids (≯25 g.) is described. Contamination of sublimate by residue is prevented by a Pyrex glass cloth resting on the solid to be distilled. An apparatus for the fractional distillation of small amounts of solid is also described.   L. S. T.

Apparatus for ammonia distillation in Kjeldahl determinations. ANON. (Suomen Kem., 1939, **12**, A, 109).—Accumulation of condensate in the distilling flask is prevented.   M. H. M. A.

Distillation capillary. A. O. GETTLER and J. FINE (Ind. Eng. Chem. [Anal.], 1939, **11**, 469—470). —The construction and use of apparatus for the fractional distillation of mixtures of 0·02—0·1 ml. of low-boiling liquids is described. Typical results for various mixtures are given.   L. S. T.

Crucible support. G. E. SEIL and H. A. HEILIG-MAN (Ind. Eng. Chem. [Anal.], 1939, **11**, 463).— A crucible support which acts as an air-bath and

eliminates spattering and creep, and reduces by one half the time required for drying, evaporating, or fuming in a Pt crucible, is described.   L. S. T.

Alkalimeter. W. H. HALL (Ind. Eng. Chem. [Anal.], 1939, **11**, 462—463).—An apparatus for the rapid, indirect determination of CO_2 is described.   L. S. T.

Generator for the production of pure carbon dioxide. E. J. POTH (Ind. Eng. Chem. [Anal.], 1939, **11**, 518; cf., A., 1931, 706).—The use and construction of an apparatus for the generation of CO_2 of a purity sufficient for the micro-Dumas N determination is described.   L. S. T.

Portable self-closing hydrogen sulphide dispenser. H. N. CALDERWOOD (J. Chem. Educ., 1939, **16**, 391—392).   L. S. T.

Hydrogen sulphide apparatus for analytical laboratories. H. KERL (Chem.-Ztg., 1939, **63**, 558).   E. C. S.

Electrical vacuum regulator. W. F. ALEWIJN (Chem. Weekblad, 1939, **36**, 598—599).—The apparatus consists of a U-tube type manometer fitted with a third limb to serve as an adjustable Hg reservoir. The open limb of the U-tube is fitted with two side arms containing Pt contacts controlling an electric circuit, which operates a weighted arm so arranged that it closes a rubber tube connected with the vac. supply when the circuit is closed owing to a rise in pressure.   S. C.

Concentration of isotopes by the evaporative centrifuge method. J. W. BEAMS and C. SKARS-TROM (Physical Rev., 1939, [ii], **56**, 266—272).—The air-driven vac.-type tubular centrifuge was used for the concn. of the isotopes of Cl by the " evaporative " centrifuge method. Operational data are reported ; the separations obtained were about the same as those predicted by theory.   N. M. B.

Pure ethyl alcohol for absorption spectrophotometry. A. CLOW and G. PEARSON (Nature, 1939, **144**, 208).—A method of purification from the traces of absorption impurities which accompany EtOH dehydrated by an azeotropic process is described. The absorption curve of the final product was practically identical with that found by Harris (A., 1933, 661).   L. S. T.

Determination of surface tension by Jäger's method without knowing the density of the liquid. S. D. GROMAKOV (J. Phys. Chem. Russ., 1939, **13**, 551).—The pressure is measured with the jet immersed at two different depths.   R. C.

Reductor tubes of rugged design. H. G. CASSIDY (J. Chem. Educ., 1939, **16**, 343).   L. S. T.

Durable protector for cork stoppers. H. N. CALDERWOOD (J. Chem. Educ., 1939, **16**, 395—397).— Cork (but not rubber) stoppers may be treated with a protective membrane of regenerated cellulose.   L. S. T.

Precipitate dryer. A. LOWMAN (Science, 1939, **90**, 143—144).—A method of drying protein pptd. by $(NH_4)_2SO_4$, in which efflorescence is reduced to a min. and the ppt. is purified and the drying time shortened, is described.   L. S. T.

Circulation and purification of inert gases at pressures above 20 Torr. B. VOGEL (Z. tech. Physik, 1939, **20**, 220—222).—A simple, mechanically operated pump, working on the Töpler principle, for circulating inert gases at low pressures, is described. Methods of purifying the inert gases at low pressures are also described. Details for the removal of all foreign gases except H_2 by passing the gas over a heated mixture of Ca and Mg filings are given. Hydrocarbons are completely decomposed when passed over this mixture at 520°. The removal of H_2 by oxidation with CuO and absorption of H_2O produced by P_2O_5 must be repeated several times to obtain a gas spectroscopically pure.   A. J. M.

Measurement of the porosity of filters. H. WITZMANN (Chem. Fabr., 1939, **12**, 345—353).— The theory and technique of the determination of the porosity of filters from their permeability to pure liquids, the capillary rise of liquids, the air-bubble method, and their permeability to gases are described and compared. The last method has advantages in avoiding the possibility of blocking of pores and swelling of the filter material, as well as in avoiding uncertainties due to an unknown wetting angle.   J. W. S.

Nessler cylinders of lead glass. T. McLACHLAN (Analyst, 1939, **64**, 669).—Recent deliveries of Nessler cylinders were of Pb glass and therefore unsuitable for determining Pb.   E. C. S.

Mounting of small metal specimens in resin plaques. C. Y. HOPKINS (Canad. J. Res., 1939, **17**, B, 159).—The metal specimen is placed in a prepared mould of commercial polystyrene resin, m.p. 175—185°, and firmly set by the application of 1000 lb. per sq. in. at 125°.   D. F. R.

Device to prevent bumping and promote boiling. S. PALKIN and T. C. CHADWICK (Ind. Eng. Chem. [Anal.], 1939, **11**, 509—510).—The device consists essentially of glass thread wound closely around a wide test-tube the interior of which is heated either by steam or by asbestos-covered nichrome wire immersed in oil. Construction of the device and its performance in vac. distillation are described.   L. S. T.

Laboratory flotation cell. Small pneumatic cell of all-glass construction. C. W. LEAF and A. KNOLL (Ind. Eng. Chem. [Anal.], 1939, **11**, 510—511).—The cell described requires 50 c.c. of solution, 5 g. of mineral (<200-mesh), and 30—40 c.c. of solution added to compensate for that lost as overflow. Data on the collecting action of α-$C_{10}H_7 \cdot NH_2$ and K ethylxanthate on galena are recorded.   L. S. T.

Ejector-type evacuator for wet assay systems. E. J. POTH (Ind. Eng. Chem. [Anal.], 1939, **11**, 521).— In the Pyrex apparatus described and illustrated corrosive fumes are brought in contact with live steam which is then condensed by a spray of cold H_2O. The diluted fumes are finally removed by the ordinary drainage system.   L. S. T.

Sealing platinum to Pyrex glass. E. WICHERS and C. P. SAYLOR (Rev. Sci. Instr., 1939, **10**, 245—250).—Satisfactory seals can be made by using Pt tubing instead of rod, if the diameter of the Pt tube is $\lessdot 12$ times its wall-thickness and $\succ$ twice the wall-thickness of the glass. The conduction through the metal may be increased by welding a Pt rod to the inside of the Pt tube.   D. F. R.

Measuring and automatically regulating the speed of the ultracentrifuge. Y. BJÖRNSTÅHL (Rev. Sci. Instr., 1939, **10**, 258—269).—The centrifuge speed may be measured by optical methods, employing the stroboscope or photo-cell devices. An electrical method, which is described in detail, consists in radially magnetising part of the rotor shaft and fixing a stator in the centrifuge casing. The frequency or e.m.f. of the power produced is measured by means of oscillograph, different resonance circuits, or bridge circuits and indicates the rotor speed. This method may be adapted to control the oil supply to the centrifuge turbine and thus automatically to regulate the centrifuge speed.   D. F. R.

Straightening thin tungsten wires. W. C. MORGAN (Rev. Sci. Instr., 1939, **10**, 271).—The wire is heated to redness and twisted while being stretched. Three complete turns per 15 cm. length of 200-μ. wire and 0·5 cm. stretching is sufficient.   D. F. R.

Rapid measurement of glass capillary diameters. G. GLOCKLER and W. HORWITZ (Rev. Sci. Instr., 1939, **10**, 271).—Standard twist drills are inserted into the bore.   D. F. R.

[Laboratory] experiment on low-pressure technique. H. H. ROWLEY (J. Chem. Educ., 1939, **16**, 274—276).—The technique of calibrating and using a McLeod gauge is described.   L. S. T.

Rubber-lined tapered vacuum joint. H. KERSTEN and A. M. CHACE (Rev. Sci. Instr., 1939, **10**, 271).—If a thin rubber gasket is inserted in large vac. joints the two halves need not be perfectly ground or be constructed from very massive material.   D. F. R.

Vial holder. J. A. QUENSE and W. M. DEHN (Ind. Eng. Chem. [Anal.], 1939, **11**, 483).—A wire holder suitable for use with a steam-bath or hot plate is described.   L. S. T.

Demonstration of oxygen in the air. M. KENTTÄMAA (Suomen Kem., 1939, **12**, A, 108—109).— Apparatus for lecture demonstration of O_2 in air, using P, is described.   M. H. M. A.

Ira Remsen. F. H. GETMAN (J. Chem. Educ., 1939, **16**, 353—360).—Biographical.   L. S. T.

Berthold Schwarz. R. E. OESPER (J. Chem. Educ., 1939, **16**, 303—306).—Historical.   L. S. T.

Geochemistry.

Thermal water of Corniglio (Parma). G. ILLARI and L. CATTADORI (Annali Chim. Appl., 1939, 29, 289—295).—Data for physico-chemical and chemical characteristics and for ionic activities are tabulated and discussed. F. O. H.

Chemical and physico-chemical analysis of mineral water of Villa Gandolfi (Turin). F. BIGLIETTI (Annali Chim. Appl., 1939, 29, 316—332).—Data (including ionic activities) are tabulated and discussed. F. O. H.

Medicinal springs of the Marienbad region. H. STADLINGER (Chem.-Ztg., 1939, 63, 565—568, 573—576).—A general account of the geological, hydrological, and chemical relations. L. J. S.

Occurrence, pathological action, and treatment of fluoride waters. M. S. NICHOLS (Amer. J. Publ. Health, 1939, 29, 991—998).—In H_2O supplies, F' in concns. $\not> 1$ p.p.m. is probably harmless (? beneficial) to human health. A review is given of the F-containing H_2O supplies of the U.S.A., of the related occurrence of mottled enamel, and of the geological formations from which the supplies are derived. Of the igneous rocks, 85% contain F, the content being 0·01—3·36% (average 0·23%). The F content of supplies is best diminished by filtration through $Ca_3(PO_4)_2$ or similar minerals, spent material being treated successively with 1% aq. NaOH and CO_2. Activated Al_2O_3, CaO, and alum are also used. W. McC.

Salt and phosphate content, temperature, surface currents, and wind direction in the Irbes Channel, determined by the lightship "Laima." E. ZARIŅŠ and J. OZOLIŅŠ (Latvij. Univ. Rakski, 1939, 4, 473—502).—The relation between direction of the wind and of surface currents, temp., and NaCl and PO_4''' content of the H_2O of the Irbes Channel (connecting the Gulf of Riga and the Baltic Sea) has been determined. The NaCl varies with the wind direction since this causes change in current direction. The PO_4''' content is small. Its seasonal variation is connected with the amount of phytoplankton present. A. J. M.

Phosphate content of the sediment in Lake Geneva. J. P. BUFFLE (Arch. Sci. phys. nat., 1939, [v], 21, Suppl., 70—73).—The P content of the mud in Lake Geneva has been tested at various depths and at various distances from the shore. In the lower strata, of glacial origin, the P content is approx. const., confirming that this P is of mineral origin. At higher levels the normal P content is lower, owing to the abundance of $CaCO_3$, but shows spasmodic increases attributed to org. matter rich in P. J. W. S.

Crystallographic investigation of glacier structure and the mechanism of glacier flow. M. F. PERUTZ and G. SELIGMAN (Proc. Roy. Soc., 1939, A, 172, 335—360).—Samples of ice were taken from crevasses and pits in the Great Aletsch Glacier; the size, shape, and orientation of the crystals were studied by optical methods. In the transition of firn to glacier ice the air spaces in the firn are reduced in no. by the growth of the crystals. At the surface of the glacier the hexagonal axis of the crystals tends to be at right angles to the surface and parallel to the temp. gradient. At a lower level representing ice 6—8 years old, the orientation of the crystals is random. This is ascribed to the motion of the glacier, which is irregular on a small scale although uniform and continuous as a whole. G. D. P.

Presentation of chemical analyses of minerals. M. H. HEY (Min. Mag., 1939, 25, 402—412).—A discussion on the accuracy of chemical analyses and the calculation of the empirical unit-cell contents from the cell-sides and density. The condition in which H_2O is present cannot always be readily decided. L. J. S.

Determination of ore minerals by the imprint method. (Use of contact analysis on polished surfaces.) R. GALOPIN (Schweiz. min. petr. Mitt., 1936, 16, 1—18; Chem. Zentr., 1937, i, 2345).—The surface is moistened with acid or a suitable reagent, or treated electrolytically in presence of acid, and covered with a filter-paper (or film) impregnated with an appropriate colour or pptn. reagent. Tests for individual elements are described. A. J. E. W.

Magnetic susceptibility of Central Swiss rocks and area susceptibilities of the Alpine tracts from Flüelen to Bellinzona. J. KOENIGSBERGER (Schweiz. min. petr. Mitt., 1936, 16, 209—214; Chem. Zentr., 1937, i, 2345).—Data are given. κ is determined by the proportions of paramagnetic (biotite, amphibole, $\kappa = 1$—$2·5 \times 10^{-4}$ and 3—8×10^{-5}, respectively) and ferromagnetic minerals (magnetite, pyrrhotite, hæmatite, and ilmenite). A granite had $\kappa = 0·5$—1×10^{-5}. Eruptive rocks all possessed remanent magnetism, and hence contained ferromagnetic material. A. J. E. W.

Radioactive nodules from Devonshire. M. PERUTZ (Tsch. Min. Petr. Mitt., 1939, 51, 141—161).—The vanadiferous nodules in the Permian marls of Budleigh Salterton (A., 1931, 1390) are further described, with speculations as to their origin. The slight radioactivity is conc. in a film at the margins of the dark core. Estimates of U in the dark material gave 0·3—0·5% U. Minute specks with metallic lustre have been identified as niccolite, but no V or U mineral could be identified. New analyses of the bleached aureole and the surrounding red clay show 0·24 and 0·10% V_2O_3 respectively, and less Fe_2O_3 in the former. L. J. S.

Radium content of rocks from the Hochalm-Ankogel group [Austrian Alps]. A. WEBER (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, 145, 163—173; Chem. Zentr., 1937, i, 2345).—The radioactive elements do not form sp. minerals, owing to their low concn. in the magma, but are included in the primary deposits; the major proportion is retained by the residual solutions. Under certain magmatic conditions acid, alkali-rich rocks may be enriched in active elements on crystallisation. A. J. E. W.

"Dolomies" and dolomitic limestones. E. BRUET (Naturaliste Canad., 1939, **46**, 17—26).—Distinction is drawn between true dolomite, $CaMg(CO_3)_2$ (I), and "dolomies" or dolomitic limestones consisting of (I)-calcite mixtures. Methods of distinguishing (I) and calcite are discussed. An examination of dolomitic deposits in Tunis is recorded and the mechanism of their formation is considered.
A. G. P.

Mineralogy of desert sands. W. A. WHITE (Amer. J. Sci., 1939, **237**, 742—747).—Mineral analyses of light desert sands are recorded graphically. Calcite, and to a smaller extent apatite, appear to be diagnostic of desert sediments. None of the sands was appreciably arkosic, and none contained monazite, a mineral common to water-laid sediments. Sands of the larger desert areas have fewer mineral species than those of the smaller areas. This may be due to a maturing process which involves the elimination of those species more vulnerable to the attrition aeolian transportation.
L. S. T.

Lower Carboniferous limestones and toad-stones at Mill Close Mine, Derbyshire. J. G. TRAILL (Bull. Inst. Min. Met., 1939, No. 420, 34 pp.).—The occurrences of the toadstones and the stratigraphy of the limestone are described and discussed.
L. S. T.

Newly-recognised features of mineral para-genesis at Leadville, Colorado. E. P. CHAPMAN (Amer. Inst. Min. Met. Eng. Min. Tech., 1939, **3**, No. 5, 12 pp.).—The distribution and mineralogy of the fourth stage of sulphide deposition, characterised by Bi minerals, are described and illustrated. The minerals in order of decreasing prominence are : chalcopyrite; several varieties of galena, differing slightly from each other in the small contents of Ag, Bi, and Te; altaite; hessite; galenobismutite; alaskaite; aikinite; Au; tennantite; argentite; and possibly sphalerite and arsenopyrite. With the exception of Au, most of which is later, these minerals are contemporaneous and hypogene, and where they occur so that they can be mined alone, as at the Tucson mine, they constitute high-grade ore. The distribution of the Bi ores corresponds closely with that of the Au ores.
L. S. T.

Magnetite crystals from meteoric solutions. J. W. GRUNER (Econ. Geol., 1939, **34**, 342—343).—A criticism (cf. A., 1939, I, 284).
L. S. T.

Iron ores of the Wichita mountains, Oklahoma. C. A. MERRITT (Econ. Geol., 1939, **34**, 268—286).—The geology of the district, and the deposits of magnetite (I) and hæmatite (II) are described. The (I) contains from 4·4—16·1% of TiO_2. The (II) deposits are oölitic, containing bands of (II) alternating with chamosite in the spherules; they contain 7—35% Fe. The origin of the ores and their economic possibilities are discussed. Chemical analyses are recorded.
L. S. T.

Crystal structure of a natural nickel–iron alloy. E. A. OWEN and B. D. BURNS (Min. Mag., 1939, **25**, 415—424).—Pebbles of awaruite (josephinite) from Josephine Co., Oregon, contain Fe 26·50, Ni 60·42, impurities (serpentine matrix) 13·07%, ρ 6·6, and have a face-centred cubic structure with a 3·5516 A. A formula $FeNi_2$ is more probable than Fe_2Ni_5. The material contains 30 times its own vol. of H_2 and CO, which are expelled at 400—900°.
L. J. S.

"Baddelyite from Alnö"—an error. H. VON ECKERMANN (Min. Mag., 1939, **25**, 413—414).—E. Hussak in 1898 described the occurrence of baddelyite (ZrO_2) in the jacupiringitic varieties of nepheline-syenite from the island of Alnö, Sweden. The author has failed to confirm this, and he suggests that the mineral examined by Hussak was melanite garnet.
L. J. S.

Composition of francolite. E. B. SANDELL, M. H. HEY, and D. McCONNELL (Min. Mag., 1939, **25**, 395—401).—Francolite from Wheal Franco, Devon, gave CaO 53·94, MgO 0·10, P_2O_5 38·13, CO_2 3·40, F 3·71, H_2O+ 0·46, H_2O- 0·01, Fe_2O_3 0·34, insol. 1·83 = 101·92; ρ 3·178 (corr. 3·145), ω 1·629, ϵ 1·624, a 9·34 A., c 6·89 A. Staffelite is identical with this fluor-carbonate apatite. C (as CO_3 and CO_4 groups) enters in the lattice in Ca and P positions.
L. J. S.

Minerals from leucite-rich rocks of the West Kimberley area, Western Australia. R. T. PRIDER (Min. Mag., 1939, **25**, 373—387).—An amphibole resembling katophorite (but richer in K) occurs in K-rich rocks (leucite-lamproites), and is named *magnophorite*. It gave SiO_2 52·67, TiO_2 3·53, Al_2O_3 1·72, Fe_2O_3 0·58, FeO 2·41, MnO 0·06, MgO 21·32, CaO 6·95, SrO 0·15, Na_2O 3·64, K_2O 5·70, H_2O+ 0·46, F 1·29 = 100·48; ρ 3·12, α 1·616, γ 1·632. *Wadeite*, a new K Zr silicate occurring in the same rocks as hexagonal tablets, gave SiO_2 39·43, TiO_2 1·63, P_2O_5 3·15, ZrO_2 21·29, Al_2O_3 5·98, Fe_2O_3 trace, MgO 0·28, CaO 5·22, SrO 0·16, BaO 1·20, Na_2O 2·82, K_2O 18·40, H_2O+ 1·30 = 100·86; ρ 3·10, ω 1·615, ϵ 1·655. Formula, $K_2(Ca,Na)Zr(Si,Al)_4O_{12}(OH)$, or neglecting water approx. $K_2CaZrSi_4O_{12}$. Analysis of a titaniferous phlogopite (TiO_2 8·97%) is also given.
L. J. S.

Sodium calcium sulphate apatite, $Na_6Ca_4(SO_4)_6F_2$. R. KLEMENT (Naturwiss., 1939, **27**, 568).—The above compound has been prepared synthetically by fusing Na_2SO_4, $CaSO_4$, and CaF_2 (3 : 3 : 1 mol.) at 800°. The X-ray diagram of the compound corresponds exactly with that of apatite, $Ca_{10}(PO_4)_6F_2$, with a 9·51$_5$, c, 7·01$_5$ A. The lattice is somewhat larger than that of apatite. It is possible to obtain mixed apatites, e.g., $Na_4Ca_6(PO_4)_2(SO_4)_2F_2$, by fusion of the components.
A. J. M.

Chlorite veins in serpentine near Kings River, California. C. DURRELL and G. A. MACDONALD (Amer. Min., 1939, **24**, 452—456).—Mainly petrographical. Chemical composition and origin of the veins are also discussed.
L. S. T.

Darkening of cinnabar in sunlight. R. M. DREYER (Amer. Min., 1939, **24**, 457—460).—Cinnabar from certain localities only darkens quickly on exposure to sunlight. Low-grade ore darkens more rapidly than high-grade, and when darkening occurs, the presence of alkali accelerates, but H_2O decreases it slightly.
L. S. T.

Brochantite. C. PALACHE (Amer. Min., 1939, **24**, 463—481).—Morphological, X-ray, and optical

examinations show that brochantite (I) is monoclinic and that its pseudo-orthorhombic appearance is the result of twinning almost universally present. New crystallographic data for (I) from the Shattuck Mine, Bisbee, Arizona, are recorded; $a : b : c = 1.3283 : 1 : 0.6135$, β 103° 21'. Rotation and Weissenberg photographs [W. E. Richmond] give a_0 13.05, b_0 9.83, c_0 5.85 A., $a_0 : b_0 : c_0$ 1.328 : 1 : 0.611, β 103° 22', V_0 750 A.³; space-group C_2^5—$P2/a$. ρ is 3.97, and the unit cell contains $4[Cu_4(SO_4)(OH)_6]$. L. S. T.

Cristobalite in southwestern Yellowstone Park. A. D. Howard (Amer. Min., 1939, 24, 485—491).—New, widespread, and abundant occurrences of cristobalite are described, and their origin is discussed. L. S. T.

Quartz "dykes." (A) G. M. Furnival. (B) C. Tolman (Amer. Min., 1939, 24, 499—507, 519—521).—(A) A review, showing that no occurrence of a body of quartz which has formed by direct crystallisation from an igneous magma is known (cf. Tolman, ibid., 1931, 16, 278).
(B) A reply. L. S. T.

Shortite, a new carbonate of sodium and calcium. J. J. Fahey (Amer. Min., 1939, 24, 514—518).—Shortite (I), $Na_2CO_3,2CaCO_3$, orthorhombic, $a : b : c = 0.455 : 1 : 0.648$, hardness 3, ρ 2.629, α 1.531, β 1.555, γ 1.570 (all ±0.002), occurs in cores of clay shale at Sweetwater Co., Wyoming. The crystals are strongly pyroelectric. (I) has a conchoidal fracture and vitreous lustre. Inversion takes place at 200° accompanied by decrepitation, and incongruent melting occurs at ~600°. Cold H_2O extracts Na_2CO_3. Chemical analyses are given. SO_3, Cl, F, SiO_2, R_2O_3, SrO, BaO, K_2O, Rb_2O, Cs_2O, and Li_2O are absent. L. S. T.

Staining of felspathoids, and zonal structure in nepheline. S. J. Shand (Amer. Min., 1939, 24, 508—513).—HCl vapour is preferable to conc. HCl for attacking rock sections of nepheline (I). A saturated aq. solution of $KHSO_4$ also attacks (I), giving a thick gel, but not leucite (II). Saturated aq. $H_2C_2O_4$ dissolves (I) giving only a thin deposit of SiO_2 gel. It slowly attacks (II) and CaO-rich plagioclase. The Na_2O-felspathoids are best attacked by 85% H_3PO_4, and then stained with methylene-blue. (I), sodalite (III), and analcime (IV) are stained deep blue, and melilite a lighter blue, but (II) is unaffected. After staining, (I) can be distinguished from (III) or (IV) by its birefringence. Zoning in crystals of (I), as revealed by staining, is described; it is due to the rhythmic deposition of layers of (I)-material alternately richer and poorer in SiO_2. L. S. T.

Significance of bornite–chalcocite micro-textures. G. M. Schwartz (Econ. Geol., 1939, 34, 399—418).—The different types of micro-textures to be observed between bornite and chalcocite in polished ore sections are described, and illustrated by means of photomicrographs. The interpretation of the origin of the texture is given. L. S. T.

Telluride tungsten mineralisation of the Magnolia mining district, Colorado. A. S. Wilkerson (Econ. Geol., 1939, 34, 437—450).—The general geology and the structure of the district are described. The Au telluride fissure zones contain sylvanite as the main ore mineral, accompanied by one or more of the following tellurides; calaverite, petzite, hessite, coloradoite, and altaite. Quartz (I), disseminated pyrite (II), small amounts of native Au, sphalerite (III), marcasite, fluorite, and calcite are also present. The W fissures contain ferberite, (I), (II), (III), and small amounts of alunite. Paragenesis and origin of the ore are discussed. L. S. T.

Slates of East Tennessee. H. C. Amick (Econ. Geol., 1939, 34, 451—458).—Various slate formations are described. Slate of commercial quality is confined to the Pigeon formation of the early Cambrian Ocoee series. Slate from the Panther Creek quarry has SiO_2 58.45, Fe 10.22, Al_2O_3 18.38, CaO 0.80, and MgO 3.15%. L. S. T.

Structural relations of some gold deposits between Lake Nipigon and Long Lake, Ontario. E. L. Bruce (Econ. Geol., 1939, 34, 357—368).—The structural relations of the ore bodies at the Northern Empire, Leitch, Sand River, Bankfield, Little Long Lac, MacLeod–Cockshutt, and Hardrock mines are discussed. Most of the ore bodies are in sediments and, in general, are localised where there is considerable heterogeneity in the country rocks. Fracturing and ore deposition were later than the periods of intrusion of all the igneous rocks except the diabase. Conditions which have resulted in localisation of ore bodies in this area are described. L. S. T.

Geology of the Canadian Malartic gold mine, Northern Quebec. D. R. Derry (Econ. Geol., 1939, 34, 495—523).—The geology, structure, and two types of ore bodies are described. L. S. T.

Oolitic limestone deposits of Franklin Co., Alabama. W. B. Jones (Econ. Geol., 1939, 34, 573—580).—Commercial stone appears to be confined to a belt ~15 miles long, centering around Russellville. The weathering qualities of stone from the Rockwood and Aday quarries are excellent, and reserves are considerable. L. S. T.

Noamundi iron mine. F. G. Percival (Trans. Min. Geol. Met. Inst. India, 1939, 35, 143—152).—The mine is estimated to contain ~25×10^7 tons of ore with an average Fe content >60%. The ore, which is almost entirely hæmatite, is described. L. S. T.

Ammonium mica synthesised from vermiculite. J. W. Gruner (Amer. Min., 1939, 24, 428—433).—Treatment of vermiculite (I) with H_2O_2 and aq. NH_3 at room temp. or with aq. $(NH_4)_2CO_3$ at 300° in a bomb produces an NH_4 mica. Owing to the difficulty of access of NH_4 between all the layers, replacement of H_2O layers by those of NH_4 is not complete. The probable presence of chlorite units between those of (I) also produces incomplete substitution. At room temp. Na˙ and K˙ do not produce micas, but at 300° in a bomb KCl produces a mica. The entry of charged NH_4 groups into apparently neutral layers of (I) may be due to the existence of charges between the layers of (I) in the form of H_3O groups. L. S. T.

Perthite from Tory Hill, Ontario. S. S. GOLDICH and J. H. KINSER (Amer. Min., 1939, **24**, 407—427).—A well-developed perthitic intergrowth of microcline and albite occurs in pegmatite masses in syenite near Tory Hill, Haliburton Co., Ontario. Uniformity in orientation and size of the albite spindles and the unusually high proportion of (I) are the main features of this intergrowth. Textural characteristics, optical data, and chemical analyses are recorded. This felspar has features in common with Ceylon moonstone. Its origin is discussed.
L. S. T.

Metakaolin. L. TSCHEISCHWILI, W. BÜSSEM, and W. WEYL (Ber. Deut. Keram. Ges., 1939, **20**, 249—276).—The thermal decomp. of kaolin (natural and synthetic) and pholerite was studied by X-ray diffraction methods and by the use of the fluorescent properties of morin. Morin develops a strong fluorescence in presence of sol. Al salts and γ-Al_2O_3, a moderate fluorescence with hydrates of Al_2O_3, but no effect at all with α-Al_2O_3. The fluorescence spectra of the suspensions of the minerals, before and after heating to temp. within the range 400—1100°, were determined. Kaolin heated at $<$400° gives only a slight fluorescence intensity (due to kaolin itself), at 400—700° it increases due to the formation of metakaolin, at 800° it reaches a marked max. due to the formation of γ-Al_2O_3, and at $>$800° it decreases again very rapidly owing to the recombination of the Al_2O_3 with the SiO_2. X-Ray examination supports the theory of the formation, at 500—700°, of a compound (metakaolin) consisting of linkages of SiO_4 and AlO_4 groups.
J. A. S.

Caledonite. C. PALACHE and W. E. RICHMOND (Amer. Min., 1939, **24**, 441—445).—Crystallographic data for caledonite (I) from the Talisman Mine, Beaver Creek, Utah, are recorded. (I) has $a : b : c =$ 0·3555 : 1 : 0·3263, a_0 7·14, b_0 20·06, c_0 6·55 A., $a_0 : b_0 : c_0 =$ 0·356 : 1 : 0·326, V_0 938·3 A.^{3}; space-group D_{2h}^{13}—P_{nmn}, ρ 5·76$\pm$0·01, and formula $2[Cu_2Pb_5(SO_4)_3(CO_3)(OH)_6]$.
L. S. T.

Rhyodacite from the Tranquille plateau, British Columbia. L. S. STEVENSON (Amer. Min., 1939, **24**, 446—447).—The rhyodacite consists of phenocrysts of oligoclase (6%), sanidine (4%), quartz (3%), and biotite (1%) embedded in a microcryst. groundmass (86%). Magnetite ($\sim$0·5% of the total rock) constitutes most of the heavy minerals. Zircon, fluorapatite, sphene, and hornblende are also present.
L. S. T.

Use of the true-angled triangular projection. H. STRUNZ (Schweiz. min. petr. Mitt., 1936, **16**, 328—334; Chem. Zentr., 1937, i, 2755).—Epidote, zoisite, and ardennite are compared by Parker's method. Epidote is analogous to apatite in formula and pseudo-symmetry. Wagnerite, libethenite, and adamite are similarly related, as are epidote and zoisite.
A. J. E. W.

Hydrated aluminosilicates. V. CHARRIN (Céramique, 1936, **4**, 475—476; Chem. Zentr., 1937, i, 2755).—The occurrence, composition, properties, and uses of pholerite, allophane, pyrophyllite, halloysite, montmorillonite, and bentonite are described.
A. J. E. W.

Accessory elements in granulites from Finnish Lapland. T. G. SAHAMA (Bull. Comm. géol. Finlande, 1936, **9**, 267—274; Chem. Zentr., 1937, i, 2755).—The granulites contain NiO 0·0005—0·2, Co_3O_4 $<$0·005—0·02, Cr_2O_3 $<$0·005—0·2, V_2O_3 $<$0·01—0·02, Sc_2O_3 0·0005—0·003, Y_2O_3 $<$0·001—0·003, La_2O_3 0·001—0·005, Ce_2O_3 0·001—0·002%. Felspars contain La_2O_3 0·005—0·05, Ce_2O_3 0·008—0·05, Eu_2O_3 0·001, Y_2O_3 0·004, garnets Cr_2O_3 0·002—0·2, Sc_2O_3 0·006—0·01, Y_2O_3 0·01—0·06, and hypersthenes Cr_2O_3 0·006—0·02, Sc_2O_3 0·006—0·01, and Y_2O_3 $<$0·01%.
A. J. E. W.

Relations between the constitutions of grain phosphates and the composition of the sterile deposits to which they are subordinate. L. CAYEUX (Compt. rend., 1939, **209**, 268—269).—Typical deposits in Northern France and Tunis are discussed. The composition of the phosphate grains is independent of that of the gangue, as the grains have been formed independently and deposited in the gangue, which results from the sedimentation process of the associated sterile deposits.
A. J. E. W.

Theory of montmorillonite. R. DE LAPPARENT (Compt. rend., 1939, **209**, 279—281).—Analyses of two Algerian bentonites which give the thermal curve and X-radiogram of montmorillonite (I) correspond with the formulæ
$5 \cdot 06SiO_2, 1 \cdot 1Al_2O_3, MgO, 8 \cdot 7H_2O$ and
$4 \cdot 7SiO_2, Al_2O_3, MgO, 8 \cdot 9H_2O$, confirming that (I) should be formulated $5SiO_2, Al_2O_3, MgO, H_2O + nH_2O$. The proposed structure is based on a chlorite model with alternate $MgAl_2Si_4O_{10}(OH)_2$ and $Si(OH)_6$ units. The latter occur in varying stages of hydration {the first being $[Si(OH)_6 - 3H_2O]$, cell height 12·4 A.} as H_2O is readily eliminated from the $Si(OH)_4$ groups, and the larger units tend to satisfy the affinity of Si for OH' ions; this accounts for the structural swelling of wet (I), which is not explained by a structure of neutral pyrophyllite units.
A. J. E. W.

New occurrence of sapphire. E. JÉRÉMINE (Bull. Soc. franç. Min., 1936, **59**, 347—348; Chem. Zentr., 1937, i, 1401).—Sapphire occurs in pegmatite inclusions south of Marignisandougon, Guinea.
A. J. E. W.

Identity of dakeite and schroeckingerite. R. NOVÁČEK (Amer. Min., 1939, **24**, 317—323).—Optical properties, chemical analyses, dehydration curves, and Debye–Scherrer diagrams show that dakeite from Wyoming (A., 1937, I, 431) and schroeckingerite from Joachimstal are identical minerals.
L. S. T.

Sienna (" ocher ") deposits of the Cartersville District, Georgia. T. L. KESLER (Econ. Geol., 1939, **34**, 324—341).—The occurrence and origin of these deposits are discussed together with the structure and hydrothermal minerals of the associated country rocks.
L. S. T.

Brookite in the Millstone Grit of Yorkshire. J. A. BUTTERFIELD (Geol. Mag., 1939, **76**, 220—228).—The characteristics of the various types of authigenic brookite occurring in the Grits are described and illustrated, and their distribution recorded. The

Grits contain unusually large amounts of Ti minerals, which comprise >50% of the heavy minerals present. L. S. T.

Anomalies in the properties of cassiterite. J. D. GOTMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 470—472).—The anomalous optical properties of cassiterites support the previous suggestion that the colouring of cassiterites is caused not by the colouring properties of traces of impurities but by those properties in the cryst. lattice which are caused by the presence of admixtures. W. R. A.

Effect of alumina on the optical properties of tremolite. D. P. GRIGORIEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, **23**, 71—73).—Tremolites containing 1—10% Al_2O_3 have been synthesised. n of the artificial amphibole thus obtained decreases with increasing concn. of Al_2O_3. The birefringence and angle of extinction also decrease slightly. A. J. M.

Migmatites from the Thuringian Forest. W. KOCH (Tsch. Min. Petr. Mitt., 1939, **51**, 1—101).—Detailed petrographical descriptions are given of mixed rocks at the junction of granite with gneisses and schists. A chemical analysis is given of diorite derived from amphibolite. L. J. S.

Lautite, CuAsS. R. WEIL and R. HOCART (Compt. rend., 1939, **209**, 444—445).—The occurrence, cleavage, and twinning of a specimen are described. Lautite does not resemble sulphides of the marcasite type, its structure being related to that of Zn blende (I). The unit cell (a_0 [100] 3·78, b_0 [010] 5·47, c_0 [001] 11·47 A.) contains 4 mols., the a_0 and b_0 axes corresponding with the [101] and [010] axes of (I). A. J. E. W.

Exfoliation of vermiculite by chemical means. (MISS) R. C. GROVES (Nature, 1939, **144**, 554).—Complete exfoliation occurs when vermiculite is covered with 20-vol. H_2O_2 and kept at room temp. Warming hastens the effect. Treatment with $KMnO_4$ and HCl produces some exfoliation and separation of the lamellæ, but < that given by H_2O_2. L. S. T.

Vanadiferous nodules in Worcester clay. J. N. FRIEND and R. H. VALLANCE (Nature, 1939, **144**, 286).—Small black to grey nodules containing 5·6—8·6% V_2O_5 occur in the Keuper marls of Gregory's Bank, Worcester. The nodules, which also contain traces of Ti, but no Ni, are surrounded by a green aureole, containing Fe^{II}, in the red marl. They resemble the larger nodules found in the red Permian marls of S. Devon (A., 1931, 1390). L. S. T.

Electronic conduction of magnetite and its transition point at low temperatures. E. J. W. VERWEY (Nature, 1939, **144**, 327—328).—The resistance of sintered magnetite of a composition $\sim Fe_3O_4$ gradually increases on cooling from 300° to 120° K. and then increases suddenly at $\sim$117° by a factor of $\sim$100. This effect is suppressed by an excess of O in the lattice. The electronic nature of the transition point is discussed. L. S. T.

Geology of the Mascoma Quadrangle, New Hampshire. C. A. CHAPMAN (Bull. Geol. Soc. Amer., 1939, **50**, 127—180).—Descriptive. The origin of the Oliverian magma series and the metamorphism of the rocks of the area are discussed. L. S. T.

Loch Borolan laccolith, N.-W. Scotland. S. J. SHAND (J. Geol., 1939, **47**, 408—420).—The main part of this eruptive mass has the form of a laccolith which appears to rest on a floor of limestone. The SiO_2 content of the rocks decreases progressively from the top to the base of the laccolith, and the rocks near the base develop melanite, dipside, and nepheline. Petrogenesis is discussed, and chemical analyses are recorded. L. S. T.

Kyanite-gedrite parageneses. C. E. TILLEY (Geol. Mag., 1939, **76**, 326—330).—Petrological. A chemical analysis [H. C. G. VINCENT] of gedrite from kyanite-garnet gedritite, Shueretsky, Karelia, is included. L. S. T.

Spheroidal inclusions containing iron in Czecho-Slovakian soils. L. SMOLIK (Sborn. českoslov. Akad. Zemĕd., 1936, **11**, 413—419; Chem. Zentr., 1937, i, 2570).—The inclusions form rust-coloured balls, cemented together by a heavy material, and $\sim$10 mm. in diameter; their no. at first increases with depth, and then decreases abruptly. Analyses of the inclusions and the surrounding soil, respectively, are as follows : SiO_2 68·47, 59·26; Al_2O_3 17·87, 12·63; Fe_2O_3 6·68, 3·84; TiO_2 0·42, 0·1; Ca 1·68, 1·76; Mg 0·92, 0·63; P 0·31, 0·136%. A. J. E. W.

Texas surface soils. W. F. TANNER (Econ. Geol., 1939, **34**, 459—460).—The distribution of Fe in wind-blown sands of Lynn and Lubbock counties in W. Texas is discussed. L. S. T.

Coal metamorphism in the Anthracite–Crested Butte Quadrangles, Colorado. E. C. DAPPLES (Econ. Geol., 1939, **34**, 369—398).—Anthracitisation is discussed from the evidence afforded by the coals of different rank that occur in a restricted area in this district. Some of the coals have been altered by the intrusion of laccoliths, whilst others have been affected only by minor folding. The effects of heat and pressure in the development of anthracite are discussed, and evidence that both temp. of 300—350° and pressures of $\sim$1400—2800 atm. are essential is presented. A theory of anthracitisation utilising shear strains and heat developed through friction is put forward. L. S. T.

Nomenclature of the megascopic description of Illinois coals. G. H. CADY (Econ. Geol., 1939, **34**, 475—494).—The application of the terms vitrain, clarain, durain, and fusain to Illinois coals is explained. L. S. T.

Relationship of structure to petroleum production in Eastern Venezuela. W. MILLER (Econ. Geol., 1939, **34**, 524—536).—The Maturin Basin is characterised by sediments of Cretaceous to Recent age. A thick blanket of Pleistocene and Recent deposits covers practically all the oil formations. Production is described. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

DECEMBER, 1939.

Second spectrum of chlorine and its structure. C. C. KIESS and T. L. DE BRUIN (J. Res. Nat. Bur. Stand., 1939, **23**, 443—470).—From observations using Geissler tubes and electrodeless discharges as light sources, new $\lambda\lambda$ of Cl II between 9483 and 2100 A. have been derived and used to extend the analysis of the term system of Cl II. An ionisation potential of 23·70 v. is derived for Cl^+.
J. W. S.

Arc spectrum of europium. H. N. RUSSELL and A. S. KING (Astrophys. J., 1939, **90**, 155—203; cf. A., 1939, I, 502).—The lowest level is $f^7s^2\ {}^8S^0$, the no. of classified lines is 1156, and the ionisation potential is $5·64\pm0·01$ v. Tables showing the terms and unclassified levels, the electron configurations, the series relations, multiplet intensities, and a complete list of classified lines are given.
L. S. T.

Influence of temperature on the pressure broadening of spectral lines. H. HORODNICZY and A. JABŁOŃSKI (Nature, 1939, **144**, 594; cf. A., 1939, I, 112).—A rise in temp. increases slightly the width and decreases the asymmetry of the Hg line 2537 A. broadened by A. The effect is $<$ that predicted by the theories of Lorentz and of Weisskopf.
L. S. T.

Interpretation of the red shifts of the light from extra-galactic nebulæ. M. E. J. GHEURY DE BRAY (Nature, 1939, **144**, 285).—The calc. velocities of recession of these nebulæ are so large that their reality is doubted. An alternative explanation of the red shift, based on the fact that vals. of c determined since 1900 show a steady decrease with time, is proposed.
L. S. T.

Nature of the nebular red shift. E. SCHRÖDINGER (Nature, 1939, **144**, 593).
L. S. T.

Forbidden $^3P_0$–$^1D_2$ line of O III in the nebular spectrum of Nova Herculis 1934. J. DUFAY and M. BLOCH (Nature, 1939, **144**, 593—594).—The faint radiation observed at $4932·2\pm0·6$ a. in the spectrum of this nova is attributed to the above transition.
L. S. T.

X-Ray K absorption edges of the elements Fe (26) to Ge (32). W. W. BEEMAN and H. FRIEDMAN (Physical Rev., 1939, [ii], **56**, 392—405).—In view of unsatisfactory available data on absorption limits, structures of the edges were measured with a double-crystal spectrometer. Results are plotted and new max. and min. in the regions of secondary structure are resolved; intensity measurements show marked disagreement with those obtained photographically. Widths of energy levels and of K states, and $\lambda\lambda$ of absorption limits, are determined. The

shapes of emission lines and absorption edges are explained on the basis of distributions of states in the electronic energy bands of the metals; quant. agreement in the case of Cu is obtained.
N. M. B.

Intensities of the K-series of X-ray lines of tungsten and platinum. W. H. KLIEVER (Physical Rev., 1939, [ii], **56**, 387—391).—Measurements are reported for the relative intensities of $K\alpha$ and $K\beta$ lines of $_{74}W$ and $_{78}Pt$ made with a double-crystal spectrometer, high-pressure A ionisation chamber, and amplifier by measuring the areas under the curves of the lines plotted against Bragg angle. Results are discussed in relation to calc. data.
N. M. B.

Element 93 in the natural state. H. HULUBEI and (MLLE.) Y. CAUCHOIS (Compt. rend., 1939, **209**, 476—479; cf. A., 1938, I, 488).—The natural existence of element 93 is confirmed by a detailed examination of the L X-ray spectrum of material isolated from a no. of minerals. The final enrichment is effected by co-pptn. with PtS_2 and progressive elimination of the Pt. The best results were obtained with a tantalite from the Haute-Vienne, columbo-tantalites, Pt metals, and certain Madagascar betafites. The preps. emit short-range α-rays. The existence of Ma (43) is unconfirmed.
A. J. E. W.

Weak lines in the molybdenum L spectrum. W. VEITH and P. KIRKPATRICK (Physical Rev., 1939, [ii], **56**, 705).—Using improved apparatus, attempts to detect non-diagram lines in the L group of Mo, analogous to those of Ag found by Burbank (cf. A., 1939, I, 502), were unsuccessful.
N. M. B.

Zeeman effect in the hyperfine structure of I II. A. S. FRY and R. A. FISHER (Physical Rev., 1939, [ii], **56**, 669—674).—Observations of the Zeeman effect in the hyperfine structure of I II lines for fields of 4000—16,000 gauss confirm the val. 5/2 for the spin of the I nucleus. The patterns observed in intermediate fields are interpreted on the Goudsmit–Bacher theory. Evidence of a nuclear quadrupole interaction is detected in some Zeeman patterns.
N. M. B.

Periodic deviation from the Schottky line. I. R. L. E. SEIFERT and T. E. PHIPPS. II. D. TURNBULL and T. E. PHIPPS. (A) H. M. MOTT-SMITH (Physical Rev., 1939, [ii], **56**, 652—663, 663—667, 668—669).—I. Data are reported and plotted for a periodic deviation observed for W and Ta, increasing above experimental error for fields $>4\times10^4$ v. per cm. The magnitude of the deviations decreases with increasing temp.

II. The deviation reported above, studied in greater detail for W up to fields of $6·5\times10^5$ v. per cm., continued with increasing period and amplitude up

to the highest fields. The characteristic Schottky distance from the surface is calc. for all vals. of the field at which max. and min. vals. of the deviation occur.

(A) An explanation based on partial reflexion of the emitted electrons at the potential barrier formed by the combination of the Schottky image force with the external field is briefly developed. N. M. B.

Energy distribution of secondary electrons at low temperatures. A. BOJINESCO (Compt. rend., 1939, **209**, 512—513).—The secondary emission of Al bombarded with 300 e.v. electrons at 90·5° and 293° K. consists of elastically reflected electrons, diffused electrons (energies 45—280 e.v.), and true secondary electrons with energies <45 e.v. These last are partly of thermal origin, but their persistence at 90·5° K. indicates a new emission mechanism in which the secondary electrons are emitted from Al atoms, and their velocity depends on the depth of penetration of the primary electrons. The data for the higher energies indicate a minor modification of cryst. structure in Al at low temp. A. J. E. W.

Secondary emission. D. E. WOOLDRIDGE (Physical Rev., 1939, [ii], **56**, 562—578).—Mathematical. A quantum-mechanical treatment of the production of secondary emission by the interaction of bombarding electrons with the valency electrons of a metal target leads to yield–bombarding energy curves in approx. agreement with experiment. A semi-quant. derivation of the primary voltage for max. yield, the effect of work function on the emission, and the energy range of the secondary particles is obtained in terms of the properties of the target material. N. M. B.

Multiple scattering of fast electrons. N. L. OLESON, K. T. CHAO, J. HALPERN, and H. R. CRANE (Physical Rev., 1939, [ii], **56**, 482).—Approx. identical scattering curves are obtained from cloud-chamber measurements of the scattering (observed deflexions being mainly due to multiple scattering) of 2—8- Me.v. electrons in Pb and C sheets of such thickness that NtZ^2 was the same for both (N = no. of nuclei per c.c.; t = thickness of sheet; Z = at. no.). Results confirm the dependence of scattering on Z^2 for Z = 6—82. Experimental vals. of $H\rho\theta$ (θ = scattering angle) are only 58% of theoretical vals. (cf. Fowler, A., 1938, I, 546; 1939, I, 2). N. M. B.

Elastic electron scattering in gases. J. H. McMILLEN (Rev. Mod. Physics, 1939, **11**, 84—110).— A review of the experimental and theoretical results which have been obtained for 25 different gases since 1927. A. E. M.

Reflexion of electrons by metals. L. A. MacCOLL (Physical Rev., 1939, [ii], **56**, 699—702).— Mathematical. The specular reflexion of electrons by metallic surfaces is considered. The reflexion coeff. R is calc. for a practical range of vals. of the potential energy of an electron, and for the range of vals. of energy of the electrons in which R is appreciable. N. M. B.

Extremely bright spots on a Coolidge tube target. (A) I. KOGA and M. TATIBANA. (B) J. FORMAN (Nature, 1939, **144**, 511).—(A) Brilliant spots and scratch markings observed on the Mo target of a Coolidge tube emitting X-rays may be due to electronic bombardment of minute protrusions on the target surface.

(B) Similar effects have been noted when using multi-segment magnetrons, and in a Farnsworth cold-cathode multiplier. L. S. T.

Formation of ions in the cyclotron. R. R. WILSON (Physical Rev., 1939, [ii], **56**, 459—463).— Initial ionisation in a cyclotron, produced by the use of a filament, is plotted as a function of pressure, electron emission, and dee voltage. The ionisation is too great to be simply explained by an electron passing between dees only once, and an experimentally supported theory is proposed whereby some of the electrons are caught by the changing electric field between the dees and oscillate many times during a cycle of the dee voltage. N. M. B.

Helium and hydrogen of mass 3. L. W. ALVAREZ and R. CORNOG (Physical Rev., 1939, [ii], **56**, 613; cf. A., 1939, I, 545).—The isotopic ratio ^{3}He/^{4}He of spectroscopically pure (atm.) He is ~12 times that for tank (gas-well) He. When a cyclotron chamber is filled with atm. He, the ^{3}He beam has sufficient intensity to induce a 2·5-min. activity in Si, probably ^{30}P formed in the reaction $^{28}_{14}$Si + $^3_2$He → $^{30}_{15}$P + $^1_1$H; $^{30}_{15}$P → $^{30}_{14}$Si + e^+. In a search for the radioactivity of ^{3}H, D_2 gas was bombarded with deuterons and passed into an ionisation chamber connected to an amplifier. The gas showed an activity of long half-life and was shown, by diffusion through hot Pd, to have the properties of hydrogen. N. M. B.

Nuclear magnetic moments of the isotopes of rubidium and chlorine. P. KUSCH and S. MILLMAN (Physical Rev., 1939, [ii], **56**, 527—530).—The nuclear gyromagnetic ratios of ^{87}Rb, ^{85}Rb, ^{37}Cl, and ^{35}Cl, measured by the mol. beam magnetic resonance method, are 1·820±0·006, 0·536±0·002, 0·454±0·002, and 0·546±0·002, respectively. These vals., with the known nuclear spins, give magnetic moments ^{87}Rb 2·741±0·009, and ^{85}Rb 1·345±0·005, compared with 2·67 and 1·32 calc. from the hyperfine structure of the ground state. The moment ratio 2·038 compares with 2·026 from at. beam measurements (cf. A., 1936, 1168), indicating that any contribution to hyperfine structure by a form of interaction, not electromagnetic in character, between electrons and nucleus is very small. The nuclear moment of ^{35}Cl is 1·365±0·005, assuming a band spectra spin of 5/2 for the nucleus. No information on the spin of ^{37}Cl is available. N. M. B.

Radioactive isomer of ^{87}Sr. L. A. DU BRIDGE and J. MARSHALL (Physical Rev., 1939, [ii], **56**, 706— 707).—Evidence is given that the 3-hr. activity produced by Sr + d and Sr + n (slow), attributed to ^{89}Sr by Stewart et al. (cf. A., 1938, I, 8), is due to an excited state of stable ^{87}Sr; it is found to be produced strongly by Rb + p at 6 Me.v., and there is also a strong period of ~60 days, probably due to ^{85}Sr. The electron spectrum in each case consists only of a strong line at 360 ke.v., and this is also shown by an 85±5-hr. Y activity produced by Sr + p or Sr + d. Sr extracted from an aged sample of this activity shows

a 2·7-hr. period. It is concluded that the 85- and 2·7-hr. periods are due to isobars of mass 87. ^{87}Y decays by K electron capture to ^{87*}Sr, which goes to the ground state ^{87}Sr with the 2·7-hr. period and the emission of a partly converted 370-ke.v. γ-ray. The same ^{87*}Sr is also produced directly by ^{87}Rb (p, n) and ^{86}Sr (n, γ).   N. M. B.

At. wt. of the chlorine isotopes ^{35}Cl and ^{37}Cl isolated by Clusius and Dickel. O. HÖNIGSCHMID and F. HIRSCHBOLD-WITTNER (Z. anorg. Chem., 1939, 242, 222—224).—At. wt. determinations of the Cl in two fractions of HCl separated by the method of Clusius and Dickel (A., 1939, I, 442) gave vals. of 36·956 and 34·979 for the heavy and light fractions, respectively. This shows that an almost 100% separation of the Cl isotopes was achieved.
                    O. J. W.

Micro-calorimetric measurement of the mean energy of disintegration of radium-E. M. LECOIN and I. ZLOTOWSKI (Nature, 1939, 144, 440—441).—The method described gives a val. of 320±5 ke.v. for the mean energy of this disintegration. The most probable val. is near the lower limit.   L. S. T.

Study of the radiation intensity in the neighbourhood of radioactive preparations with thin-walled ionisation chambers. H. SMEREKER (Strahlenther., 1937, 58, 267—285; Chem. Zentr., 1937, i, 3001).—The effects of the form of the Ra prep., filters, the distance from the source, and other factors are studied.   A. J. E. W.

β Spectrum of actinium-K. (MLLE.) M. PEREY and M. LECOIN (Nature, 1939, 144, 326; cf. A., 1939, I, 170).—Characteristics of the spectrum are tabulated and recorded graphically, and compared with those of Ac-B and Ac-C''. Ac-K may emit an intense γ-radiation of >3 Me.v. The upper limit of the spectrum lies at 1·2 Me.v.   L. S. T.

Stability of the isobars Cd–In, In–Sn, Sb–Te, Re–Os. P. SCHERRER and E. ZINGG (Helv. Phys. Acta, 1939, 12, 283—285).—The pairs $^{113}_{48}$Cd–$^{113}_{49}$In, $^{115}_{49}$In–$^{115}_{50}$Sn, $^{123}_{51}$Sb–$^{123}_{52}$Te, $^{187}_{75}$Re–$^{187}_{76}$Os show neither positron- nor electron-activity, nor internal electronic transitions giving rise to K- or L-radiation corresponding with a half-val. period of <10^{12} years. This stability is explained by Dempster's empirical packing curve.   L. J. J.

Scattering of D–D neutrons. W. D. ALLEN and C. HURST (Nature, 1939, 144, 509—510).—Using P as a fast neutron detector, the vals. obtained for the scattering cross-sections, σ, of various elements for D–D neutrons are ~ one half the vals. obtained by previous observers. The periodic variation of σ with Z, shown graphically as far as $Z = 53$, supports the results of Kikuchi and Aoki (A., 1939, I, 171).
                    L. S. T.

Collimation of fast neutrons. R. F. BACHER and D. C. SWANSON (Physical Rev., 1939, [ii], 56, 483—484).—Photographs are given of the tracks of the recoils in CH_4 produced by a collimated beam of neutrons from Li and from Be targets. The neutrons were collimated by a tunnel through a wall of H_2O 75 cm. thick.   N. M. B.

β-Decay and spin of light nuclei. B. O. GRÖNBLOM (Physical Rev., 1939, [ii], 56, 508—511).—Mathematical. The β-decay of the nuclei ^{6}He, ^{7}Be, ^{13}N, ^{15}O, and ^{17}F is investigated on the basis of the Gamow–Teller modification of the Fermi theory (cf. A., 1936, 1045). The val. obtained for the decay time const. is ~3 × 10^3 sec. compared with the upper limit 11 × 10^3 sec. calc. by Bethe (cf. A., 1938, I, 550).   N. M. B.

β-Radiation of ^{76}As. G. L. WEIL and W. H. BARKAS (Physical Rev., 1939, [ii], 56, 485—486; cf. Brown, A., 1936, 1441).—Using a H_2-filled expansion chamber in magnetic fields of 800 and 342 oersteds, the momentum distribution of electrons from ^{76}As was measured. The observed upper limit was at 2·71±0·14 Me.v., and the average energy of the β-particles was 0·93 Me.v. The decomp. of the experimental curve into components and comparison with theory are discussed. The half-life of chemically separated ^{76}As is 26·75±0·15 hr.   N. M. B.

Coincidences between β- and γ-rays in manganese. L. M. LANGER, A. C. G. MITCHELL, and P. W. McDANIEL (Physical Rev., 1939, [ii], 56, 422—425; cf. A., 1937, I, 489).—Coincidences were recorded between β- and γ-radiations from ^{56}Mn (148 min.) formed by slow neutron capture. By interposing various thicknesses of Al between the source and the β-ray counter, the ratio of β–γ coincidences to single β counts was observed as a function of β-ray energy. Results indicate that ^{56}Fe is formed in two excited states from the disintegration of ^{56}Mn, and that one γ-ray per disintegration is associated with the high-energy group and ~2 γ-rays per disintegration with the low-energy group.
                    N. M. B.

Induced radioactivity in (A) europium. K. FAJANS and D. W. STEWART. **(B) Strontium and yttrium; nuclear isomers in strontium.** D. W. STEWART (Physical Rev., 1939, [ii], 56, 625—628, 629—632).—(A) Eu_2O_3 bombarded for long periods with slow neutrons from a cyclotron and with 7-Me.v. deuterons for shorter periods gives, in the first case, two periods of induced radioactivity. The first, with a half-life of 9·4±0·2 hr., is assigned to ^{152}Eu (cf. Pool, A., 1938, I, 291), which decays probably by emission of negative electrons and by the capture of K electrons; the upper limit of the β-spectrum is 1·83 Me.v. The second period, assigned to ^{154}Eu, and produced only after long exposure, showed no appreciable decay in 6 months; the upper limit of the β-spectrum is 1·0±0·1 Me.v. The 9-hr. period was produced also by deuteron bombardments together with new 12±4- and 105±5-min. periods which could not be separated chemically from the 9-hr. period and are probably due to isomeric forms of ^{152}Eu and ^{154}Eu.

(B) An extension of previous work (cf. A., 1938, I, 8) with stronger activation by deuterons and neutrons gave periods of 2·0±0·2, 14±2, and 82±4 hr. in Y separated from Sr bombarded with 7-Me.v. deuterons. The first is assigned to ^{88}Y and the others either to ^{85}Y and ^{87}Y or to isomeric forms of these. Sr bombarded with deuterons and neutrons gave periods of 3·0±0·1 hr. and 55±5 days, assigned to the decay of

isomeric forms of ^{89}Sr. The max. energies of the β-ray spectra were 0·60 and 1·50 Me.v., respectively. The γ-radiation accompanying the 3-hr. period had components of 0·55 and 1·10 Me.v. A tentative energy level diagram suggests that the metastable state of ^{89}Sr decays first by β-emission and then by emission of either one or two γ-rays. The ground state of ^{89}Sr decays directly to the ground state of ^{89}Y without γ-ray emission.   N. M. B.

Induced radioactivity produced by bombarding aluminium with protons. G. KUERTI and S. N. VAN VOORHIS (Physical Rev., 1939, [ii], 56, 614—615).—All attempts to produce ^{27}Si (6·5 min.) by proton bombardment of Al were unsuccessful (cf. Henderson, A., 1939, I, 505). An activity of 3·7 sec. half-life was, however, produced, and assuming a (p, n) reaction, evidence indicates that it is due to ^{27}Si produced in its ground state at the observed threshold 6·1 Me.v. The calc. mass is 26·9956 (^{27}Al = 26·9989) compared with the val. 26·9944 predicted by Barkas (cf. A., 1939, I, 297).
    N. M. B.

Short-lived radioactivities induced in fluorine, sodium, and magnesium by high-energy protons. M. G. WHITE, L. A. DELSASSO, J. G. FOX, and E. C. CREUTZ (Physical Rev., 1939, [ii], 56, 512—518; cf. A., 1939, I, 397).—Bombardment, with 6-Me.v. protons, of F (as PbF$_2$), Na (as NaCl), and Mg (metal) gave rise, respectively, to short-lived positron emitters ^{19}Ne (20·3±0·5 sec.), ^{23}Mg (11·6±0·5 sec.), and $^{25, 26}$Al (7·0±0·5 sec.). Decay curves, positron spectra, and threshold data are given, and results are in good agreement with theory. It is concluded that for isobars of the type (n–p) = ±1 the difference in binding energy is due solely to the effect of Coulomb forces up to at least mass no. 25. The half-lives depend on the inverse fifth power of the upper limit of the positron spectra, in agreement with theory.
    N. M. B.

Proton activation of indium and cadmium. S. W. BARNES (Physical Rev., 1939, [ii], 56, 414—421; cf. A., 1939, I, 173).—New isotopes ^{110}In (66±5 min.), ^{113*}In (105±10 min.), and ^{113}Sn (105 ±15 days) are reported. In activated by 7·2-Me.v. protons gives rise to ^{115*}In and ^{113}Sn; the latter decays by K-electron capture emitting In K X-rays. ^{113*}In was chemically separated from aged ^{113}Sn and was also formed by proton bombardment of Cd; it decays to ^{113}In with emission of a 0·39-Me.v. γ-ray. In addition, bombarded Cd shows the expected ^{111}In 20 min. (+), ^{114}In 48 days (−), and ^{116}In 54 min. (−). The provisionally assigned ^{110}In (66±5 min.) emits positrons of max. energy 1·6±0·3 Me.v. Activities of 72 sec. (−) and 2·7±0·2 days (−), the latter accompanied by 170- and 250-ke.v. γ-rays, are ascribed to isomeric states of ^{112}In.   N. M. B.

Deuteron bombardment of silver. (A) R. S. KRISHNAN and D. H. T. GANT. (B) N. FEATHER (Nature, 1939, 144, 547).—(A) Ag bombarded by 9-Me.v. deuterons from a cyclotron shows a negative electron activity of 2·4 min. due to ^{108}Ag formed by the reaction ^{107}Ag (d, p) ^{108}Ag. Chemical separation of the irradiated Ag into Ag and Cd fractions has been effected. The latter contains a 6·8-hr. body emitting

soft negative electrons, X-rays, and a very weak γ-radiation. The reaction is ^{107}Ag (d, n) ^{108*}Cd, or ^{109}Ag (d, n) ^{110*}Cd. The Ag fraction contains a 26-min. body emitting positrons, and also gives a negative electron activity with a half-life of several weeks.

(B) The method of crit. absorption applied to the radiations from Ag, bombarded as described above, supports some of the above conclusions.   L. S. T.

Nuclear transformations of nitrogen with fast neutrons. E. BALDINGER and P. HUBER (Helv. Phys. Acta, 1939, 12, 330—348).—See A., 1939, I, 443. For angles of observation 0° and 90° the difference between neutron energies observed is 0·39 Me.v.   L. J. J.

Disintegration of ^{14}N and ^{15}N produced by deuteron bombardment. M. G. HOLLOWAY and B. L. MOORE (Physical Rev., 1939, [ii], 56, 705—706).—A 4 : 1 mixture of ^{14}N$_2$ and ^{15}N$_2$ was bombarded with 1·07-Me.v. deuterons from a cyclotron and the ranges of protons and α-particles emitted at 90° to the deuteron beam were measured. A new group of protons of 66·1 cm. range, attributed to the ^{14}N (d, p) ^{15}N reaction, was observed. A new group of α-particles of range 5·09 cm. is attributed to the ^{15}N (d, α) ^{13}C reaction; the Q val. is 7·40 compared with 7·55 Me.v. calc. from mass vals.   N. M. B.

Fission of thorium by neutrons. Y. NISHINA, T. YASAKI, H. EZOE, K. KIMURA, and M. IKAWA (Nature, 1939, 144, 547—548).—Th(NO$_3$)$_4$ bombarded with fast neutrons from Li + 3-Me.v. deuterons from a cyclotron gives active Bi, Hg, Sb, Sn, Ag, and other elements as yet unidentified. Active Pb and As were absent. Similar bombardment of U gave radioactive ppts. of Bi, Hg, Ag, Sb + Sn, and Cu + Cd fraction.   L. S. T.

Energies released in the reactions ^{7}Li (p, α) ^{4}He and ^{6}Li (d, α) ^{4}He, and the masses of the light atoms. N. M. SMITH, jun. (Physical Rev., 1939, [ii], 56, 548—555).—Using improved technique, the energies of the α-particles arising from the reactions were measured by stopping the particles in a calibrated, variable-pressure, air-filled absorption cell. The vals. found were 17·28±0·03 and 22·20±0·04 Me.v., respectively. These vals., with the energies of the Be–proton disintegrations (cf. Allison, A., 1938, I, 489), lead to the following at. masses: ^{6}Li 6·01682±0·00011, ^{7}Li 7·01784±0·00009, ^{8}Be 8·00766± 0·00015, ^{9}Be 9·01486±0·00013.   N. M. B.

Particular mode of fission of the uranium nucleus. V. G. CHLOPIN, M. A. PASSVIK-CHLOPIN, and N. F. VOLKOV (Nature, 1939, 144, 595—596).—Experiments showing that two new fission processes exist in the bombardment of U by slow neutrons, and that radioactive isotopes of Kr and Xe are intermediate products of the fission, are described.   L. S. T.

Rupture of the uranium nucleus into very light atoms. J. THIBAUD and A. MOUSSA (J. Phys. Radium, 1939, [vii], 10, 388—390).—An extension of work already noted (A., 1939, I, 234). The formation of a halogen element different from I is indicated in the products from the disruption of U by neutrons.   W. R. A.

Emission of neutrons by uranium. W. H. ZINN and L. SZILARD (Physical Rev., 1939, [ii]. 56, 619—624; cf. A., 1939, I, 294).—Fast neutrons emitted from U by thermal neutrons, using a Ra–Be photo-neutron source, were investigated. The upper limit of the spectrum of the U fission neutrons is 3·5 Me.v. The no. of neutrons emitted is estimated by analysing the pulse distribution of H atoms projected by U neutrons in an ionisation chamber filled with H_2 and A, and this no. is related to the no. of fissions, comparably observed, in an ionisation chamber lined with U_3O_8 film. Hence the no. of neutrons emitted per fission is 2·3. This val., with fission cross-section 2×10^{-24} sq. cm. (cf. Anderson, *ibid.*, 235), and cross-section for radiative capture 1·3 or $1·2 \times 10^{-24}$ sq. cm. (*ibid.*, 398), leads to 1·4 for the no. of neutrons emitted by U per thermal neutron absorbed, compared with 1·5 obtained by another method (*ibid.*, 504).
                                                    N. M. B.

Heat of fission of uranium. M. C. HENDERSON (Physical Rev., 1939, [ii], 56, 703).—The heat produced in 13 g. of U bombarded with slow neutrons from a cyclotron was measured by a resistance thermometer, and the no. of fissions in 0·07 mg. of U was measured with a pulse amplifier. The calc. energy liberated per fission is 175±10% Mc.v.
                                                    N. M. B.

Angular distribution of cosmic-ray particles scattered in 1 cm. of platinum. J. A. VARGUS, jun. (Physical Rev., 1939, [ii], 56, 480—481).—Calc. data are plotted and compared with vals. obtained from measurements of cloud-chamber photographs.
                                                    N. M. B.

Upward radiation produced by cosmic rays at high altitudes. S. A. KORFF and E. T. CLARKE (Physical Rev., 1939, [ii], 56, 704).—Experiments are described in which a Geiger counter at heights up to 80,000 ft. was caused to occupy four positions relative to Pb blocks in order to investigate the effect of Pb on cosmic radiation at high altitudes. Results are analysed and indicate that ionising radiation is ejected upwards from the Pb by downward rays; this effect is probably due to reflexion of electrons, to nuclear disintegrations, and to wide-angle showers in the Pb. A large effect due to reflexion suggests the presence of many low-energy electrons in the radiation at high altitudes.
                                                    N. M. B.

Seasonal cosmic-ray effects at sea level. R. A. MILLIKAN, H. V. NEHER, and D. O. SMITH (Physical Rev., 1939, [ii], 56, 487—490).—Results obtained by sending a self-recording electroscope repeatedly on an extensive sea voyage are reported.
                                                    N. M. B.

New evidence for a change with time of the total energy brought into the earth by cosmic rays. R. A. MILLIKAN and H. V. NEHER (Physical Rev., 1939, [ii], 56, 491—493; cf. Forbush, A., 1939, I, 116).—Seasonal or atm. temp. effects at very high altitudes are masked by changes with time of the total energy brought into the earth by cosmic rays.
                                                    N. M. B.

Penetrating component of large cosmic-ray showers. P. AUGER and J. DAUDIN (Compt. rend., 1939, 209, 481—483; cf. A., 1938, I, 595; 1939, I, 55, 175).—Experiments at an altitude of 3500 m.,

using a Wilson chamber in conjunction with coincidence counters, are described. The showers consist chiefly of electrons of energy $\sim10^{10}$ e.v., which produce dense local showers in Pb screens; the energy of the primary particles is $≮10^{13}$ e.v. The penetrating component contains occasional slow protons produced by nuclear disintegration; these indicate the presence of a component which interacts strongly with at. nuclei. The density of the penetrating rays (~40 per sq. m.) is uniform over an area >20 sq. m.
                                                    A. J. E. W.

Intensity of penetrating terrestrial radiation in Auvergne. J. BRICARD and J. JUNG (Compt. rend., 1939, 209, 485—488).—The intensity of ionisation due to penetrating radiation in the neighbourhood of various strata and mineral springs is studied. Very high vals., possibly due to H_2O associated with petroleum deposits, are obtained over a disused boring in Limagne.
                                                    A. J. E. W.

Variations of large cosmic-ray showers as a function of barometric pressure, altitude, and time. P. AUGER, ROBLEY, and PLUVINAGE (Compt. rend., 1939, 209, 536—538).—Coincidence counter measurements at high altitude (Pic du Midi, $p = 7·3$ m. of H_2O) indicate the occurrence of ~180 large showers per hr., each containing ~40 trajectories per sq. m. The corresponding vals. in Paris ($p = 10·3$ m. of H_2O) are 67 and 20. A correlation of double coincidence counter data with barometric pressure gives a mass coeff. of $-0·009$ sq. cm. per g., which is also the val. obtained from the altitude effect. A temp. or diurnal variation is not observed.
                                                    A. J. E. W.

Cosmic-ray ionisation bursts. H. CARMICHAEL and C. N. CHOU (Nature, 1939, 144, 325—326).—Measurements of cosmic-ray ionisation bursts at sea-level and under 30 m. of London clay are discussed. For the underground bursts, the distribution curve calc. for cascade showers produced by electrons knocked on by mesons shows fair agreement with the observed curve. The bursts at sea-level provide evidence of extensive showers originating in the atm. but not produced by mesons.
                                                    L. S. T.

Production of the hard component of cosmic radiation. I. Photon hypothesis. L. W. NORDHEIM and M. H. HEBB. **II. Protons or neutral particles as primaries.** L. W. NORDHEIM (Physical Rev., 1939, [ii], 56, 494—501, 502—507).—Mathematical. I. With the help of the known energy distribution of the electrons coming from the outside, the energy distribution of photon lengths in the higher atm. is obtained. The hypothesis that mesons are created by photons is deduced from a comparison of the no. and energy distribution of mesons with the calc. photon lengths. Difficulties of the hypothesis are examined.

II. The general requirements for understanding the hardening of the cosmic radiation underground, together with a terrestrial origin of the hard component, are discussed. The inversion of the meson production processes, *i.e.*, absorption of mesons by production of photons or protons accompanied by multiplication of the mesons, must have cross-sections smaller by a factor ~10 compared with the production processes.

To avoid this difference, the possibility of neutral mesons as additional primaries is discussed.   N. M. B.

Time distribution of cosmic-ray bursts. P. S. GILL (Physical Rev., 1939, [ii], 56, 632—634).—An analysis of recordings of cosmic-ray bursts, produced under 12 cm. of Pb shielding at three widely separated stations, shows that the bursts form a random series of events with possible systematic diurnal variations.   N. M. B.

Transition effect for large bursts of cosmic-ray ionisation and the number of primary electrons of very high energy. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1939, [ii], 56, 640—643).—Bursts were observed in the open and under heavy roofs, with and without a 1-cm. Pb plate over the ionisation chamber. The increase in the no. of bursts in presence of Pb under heavy roofs is interpreted as an increase in the no. of rays in the showers from the roof, while in the open, bursts from the Pb probably originate largely from the action of high-energy electrons which are not members of cascade showers starting at the top of the atm. The no. and energy distribution of primary cosmic-ray electrons of energies $\sim 2 \times 10^{15}$ e.v. are derived.   N. M. B.

Nuclear disintegration induced by cosmic radiation. I. ZLOTOWSKI (Physical Rev., 1939, [ii], 56, 484—485).—A detailed discussion of a cloud-chamber photograph showing a Po α-particle track together with two tracks produced by cosmic rays in the cloud chamber shows that the longer of the two tracks must be due to a 6.3 ± 0.2-Me.v. proton and the shorter track either to a 3.7 ± 0.8-Me.v. proton or to a 2.0 ± 0.3-Me.v. deuteron. Energy considerations show that the observed nuclear process must be induced chiefly by the soft component of cosmic radiation.   N. M. B.

Heavy cosmic-ray particles at Jungfraujoch and sea level. W. HEITLER, C. F. POWELL, and G. E. F. FERTEL (Nature, 1939, 144, 283—284).—Absorption experiments in air and in Pb at Jungfraujoch and at Bristol show that the primary radiation responsible for the heavy component of cosmic rays consists neither of electrons nor of mesotrons. The heavy tracks are produced by a third component, probably neutrons (A., 1937, I, 491).   L. S. T.

Slow mesons in the cosmic radiation. C. G. MONTGOMERY, W. E. RAMSEY, D. B. COWIE, and D. D. MONTGOMERY (Physical Rev., 1939, [ii], 56, 635—639). —An experiment for measuring the disintegration time of cosmic-ray mesons is described. The no. of disintegration electrons found was ⩽ the expected 23 per hr. Explanations of the discrepancy are discussed.   N. M. B.

Intensity and rate of production of mesotrons as a function of altitude. M. SCHEIN, W. P. JESSE, and E. O. WOLLAN (Physical Rev., 1939, [ii], 56, 613—614).—Results of experiments with Geiger-Müller counters and Pb absorbers in free balloons are described. The mesotron intensity increases by a factor of 11 between sea level and 17·6 km., with no evidence for a max. in the mesotron intensity up to the highest altitude. Data indicate that mesotrons can be created by photons, and from the known intensity of the soft component the calc. cross-section for the creation of a mesotron by a photon is 1.7×10^{-27} sq. cm. per proton in the Pb nucleus (cf. Schein and Wilson, A., 1938, I, 549).   N. M. B.

New representation of the periodic system. H. G. S. SNIJDER (Chem. Weekblad, 1939, 36, 676—677).—The electronic structures of the atoms are shown in a periodic table by coloured dots placed on orbits around a central nucleus.   S. C.

Atom model which explains quantum conditions and permits the derivation by means of classical physics of Bohr's radiation laws. D. RĂDULESCU (Bull. Soc. Chim. Românîa, 1938, 20, 39—48).—Theoretical.   F. L. U.

Quantisation under two centres of forces. I. The H_2^+ ion. S. K. CHAKRAVARTY (Phil. Mag., 1939, [vii], 28, 423—434).—A mathematical analysis of the most general case of two unequally charged nuclei with one electron in their field, so that the energies of homonuclear as well as heteronuclear mols. in all their different states can be calc. The results have been applied to the $1s\sigma$, $2s\sigma$, and $3d\sigma$ states of H_2^+.   T. H. G.

Relative intensities of singlet–singlet and singlet–triplet transitions. G. W. KING and J. H. VAN VLECK (Physical Rev., 1939, [ii], 56, 464—465). —The intensity ratios can be calc. by Houston's formula (cf. A., 1929, 480) from the deviations from the interval rule and also from the distance of the singlet level from the centre of gravity of the triplet levels. The discrepancy of the two calculations indicates that singlet–triplet and triplet–triplet radial function integrals differ by a factor ~ 0.75; intensity ratios in good agreement with observed vals. are calc.   N. M. B.

Calculation of energies of two-electron configurations from Hartree functions. Application to $2p^2$ terms in O III. A. F. STEVENSON (Physical Rev., 1939, [ii], 56, 586—593).—A simplification and improvement of a generalisation of the method of the self-consistent field previously reported (cf. A., 1937, I, 441) is given. Application leads to an improved separation ratio for the O III terms.   N. M. B.

Variational atomic wave functions. L. GOLDBERG and A. M. CLOGSTON (Physical Rev., 1939, [ii], 56, 696—699).—Mathematical. The tables constructed by Morse et al. (cf. A., 1936, 133) are extended to include $3p$ and $3d$ electrons. Data for He, Li, Be, B, C, N, O, F, and Ne are tabulated.   N. M. B.

Elastic scattering of fast electrons by heavy elements. J. H. BARTLETT and R. E. WATSON (Physical Rev., 1939, [ii], 56, 612—613).—Relative scattering intensities (for angle of scattering 15—180°) and polarisation vals. are calc. for Hg from Mott's expression for the scattering of a Dirac electron in a Coulomb field (cf. A., 1932, 441).   N. M. B.

Problem of mass of an elementary particle. K. NIKOLSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 481—485).—Mathematical.   F. J. G.

The meson and cosmology. D. S. KOTHARI (Nature, 1939, **144**, 548).—Theoretical.   L. S. T.

Connexion between the life-time of the meson and the β-decay of light elements. C. MØLLER, L. ROSENFELD, and S. ROZENTAL (Nature, 1939, **144**, 629).—The quant. discrepancy between the observed and theoretical ratio of the life-time of the free meson to that of a light β-radioactive element can be eliminated by considering a mixture of independent meson fields.   L. S. T.

β-Ray selection rules and the meson theory. M. SCHÖNBERG (Physical Rev., 1939, [ii], **56**, 612).—Mathematical. The significance of the Fermi and Gamow–Teller selection rules (cf. A., 1936, 1045) is discussed from the point of view of the Yukawa theory of β-emission.   N. M. B.

Coupling conditions in light nuclei and the lifetimes of β-radioactivities. E. P. WIGNER (Physical Rev., 1939, [ii], **56**, 519—527).—Mathematical.   N. M. B.

Electric quadrupole moment of the deuteron and the field theory of nuclear forces. C. MØLLER and L. ROSENFELD (Nature, 1939, **144**, 476—477; cf. A., 1939, I, 237).   L. S. T.

Electron–positron field theory of nuclear forces. E. P. WIGNER, C. L. CRITCHFIELD, and E. TELLER (Physical Rev., 1939, [ii], **56**, 530—539; cf. A., 1938, I, 383).—Mathematical. A simple spin-independent interaction between heavy particles (neutrons and protons) and electrons is assumed. Saturation of resulting forces between heavy particles is assured by choosing a bounded interaction. The change in energy of electrons in negative levels which is caused by the presence of a heavy particle is calc. General restrictions on the choice of interactions are discussed.   N. M. B.

Spin-dependence in the electron–positron theory of nuclear forces. C. L. CRITCHFIELD (Physical Rev., 1939, [ii], **56**, 540—547).—Mathematical. Previous theory (cf. preceding abstract) is extended to account for spin-dependent phenomena. The anomalous magnetic moments of the neutron and proton can be accounted for by an adjustment of consts. Correct spin-dependence in the interaction of two heavy particles can be obtained only through an angular dependence of forces, an estimate of which, in this theory, is of correct magnitude.   N. M. B.

Binding energies of ³H and ⁵He. (MISS) K. WAY (Physical Rev., 1939, [ii], **56**, 556—561).—Mathematical. An approx. application to the nuclei ^{3}H and ^{5}He of Wheeler's method of resonating groups (cf. A., 1938, I, 57) leads to an evaluation of the magnitude of different contributions to the total energy.   N. M. B.

Phase shifts (K_1) for (A) the square well, (B) the error well. A. M. MONROE and H. M. THAXTON (Physical Rev., 1939, [ii], **56**, 616; cf. Breit et al., A., 1939, I, 395).—Mathematical.   N. M. B.

Sommerfeld's fine structure constant and Born's reciprocity. A. LANDÉ (Physical Rev.,

1939, [ii], **56**, 482—483, and J. Franklin Inst., 1939, **228**, 495—502).—Mathematical.   N. M. B.

Structure of electric particles and the number 137. A. LANDÉ (Physical Rev., 1939, [ii], **56**, 486).—Mathematical.   N. M. B.

Mechanism of nuclear fission. N. BOHR and J. A. WHEELER (Physical Rev., 1939, [ii], **56**, 426—450).—The mechanism is described on the basis of the liquid drop model of at. nuclei ; conclusions are drawn regarding the variation from nucleus to nucleus of the crit. energy required for fission and the dependence of fission cross-section for a given nucleus on exciting energy. Theory and experiment agree.   N. M. B.

Interaction between nuclear particles. E. C. G. STUECKELBERG and J. F. C. PATRY (Helv. Phys. Acta, 1939, **12**, 300—303).—Theoretical.   L. J. J.

Nuclear reactions in stellar evolution. G. GAMOW (Nature, 1939, **144**, 575—577, 620—622).   L. S. T.

Behaviour of matter at extremely high temperatures and pressures. F. CERNUSCHI (Physical Rev., 1939, [ii], **56**, 450—455).—Mathematical. It is suggested that an assembly of neutrons can form, under specified circumstances, two different phases by reason of the attracting forces between neutrons. The hypothetical transition from the dil. to the condensed neutron phase affords a physical basis for the idea that supernovæ originate from the sudden transition of an ordinary to a centrally condensed star.   N. M. B.

Phase transitions of nuclear matter. I. GUREVICH (Nature, 1939, **144**, 326—327).—Theoretical. The properties of excited nuclear matter may change at a certain temp. This phase transition may be analogous to those in liquid He and conductivity electrons in metals.   L. S. T.

Atomic constants. Revaluation and analysis of the discrepancy. F. G. DUNNINGTON (Rev. Mod. Physics, 1939, **11**, 65—83).—At. consts. and auxiliary consts. are critically reviewed. The most reliable val. for e ($4 \cdot 8025 \pm 4 \times 10^{-10}$ e.s.u.) appears to be obtained with the X-ray/ruled grating method. $m_0 = 9 \cdot 1071 \pm 14 \times 10^{-28}$ g., $h = 6 \cdot 6200 \pm 33 \times 10^{-27}$ erg sec.; N derived from these data is $6 \cdot 025 \pm 1 \times 10^{23}$ on the physical scale. There are indications that the Rydberg and inverse photo-electric equations are not quite exact, since discrepancies exist between vals. of physical consts. obtained from them and vals. derived independently.   A. E. M.

Apparent anomalous isotopic effect in some bands associated with the Swan bands. C. H. TOWNES (Nature, 1939, **144**, 631).—The weak bands λλ 4770, 4836, 4911, 4997, etc., tentatively identified as tail-bands of the Swan system, are due to C combined with a very persistent impurity. Measurements of the isotopic heads of these bands obtained from ^{12}C enriched with ^{13}C revealed an anomalously large isotopic shift.   L. S. T.

Absorption spectrum of heavy acetone in solution in hexane. L. V. KORTSCHAGIN and M. A. PIONTKOVSKAJA (Acta Physicochim. U.R.S.S., 1939, **10**, 881—884).—The ultra-violet (~2790 A.) ab-

sorption spectrum of heavy $COMe_2$ is the same as that of ordinary $COMe_2$, both in C_6H_{14}. O. J. W.

Interferometer wave-lengths of certain lines in the secondary spectrum of hydrogen. L. S. COMBES, R. M. FRYE, and N. A. KENT (Physical Rev., 1939, [ii], **56**, 678—679).—Data for 24 lines of the mol. spectrum of H_2 in the region 4900—5900 A., determined with an etalon crossed with a Littrow spectrograph, are reported. A least-squares method for calculating the $\lambda\lambda$ is described. N. M. B.

Molecular spectra of the hydrogen isotopes. II. Assumption of a common potential function for the isotopic states. I. SANDEMAN (Proc. Roy. Soc. Edin., 1939, **59**, 130—140; cf. A., 1939, I, 400).—Using the data of Dieke and Blue (A., 1935, 555) on HD and D_2, analysis by the Dunham method (Physical Rev., 1932, **41**, 721) of the $1s\sigma 2s\sigma\,^3\Sigma$ state of the isotopes H_2, HD, and D_2 indicates that whilst the lowest-quantum term-differences of the three isotopic states can be represented fairly accurately by application of the ordinary mass-effect theory of mol. isotopes, such representation of the higher-quantum term-differences is not possible. Thus while the internuclear distances in the three isotopic modifications cannot differ much, the potential functions differ and show that the field of a deuteron differs appreciably from that of a proton. W. R. A.

Absorption of solid mixtures of oxygen with nitrogen and with argon in the region 2800—2400 A. A. PRICHOTKO (Acta Physicochim. U.R.S.S., 1939, **10**, 913—934).—The prep. of transparent cryst. mixtures of O_2 and N_2 and of O_2 and A is described. The absorption spectra of these mixtures at the temp. of liquid H_2 coincide with the spectrum of solid O_2, and the general structure of the absorption spectrum is the same as that of gaseous O_2 at high pressures. In the crystal a phenomenon exists which is analogous to dissociation in a gas. From the spectrographic data the energy of dissociation of O_2 in the crystal is calc. to be 5·2 v. O. J. W.

Mechanism of nitrogen excitation in the night sky. J. CABANNES and R. AYNARD (Nature, 1939, **144**, 442). L. S. T.

Transparency of the atmosphere. III. Calculation of former measurements. J. DUCLAUX (J. Phys. Radium, 1939, [vii], **10**, 367—374; cf. A., 1937, I, 341).—Re-examination of the measurements of Müller and Kron, previously presented as a verification of Rayleigh's theory, leads actually to a different absorption law, and yields no information either on the thickness of the O_3 layer or on the no. of mols. per unit vol. of air under normal conditions. The difference between the experimental absorption law and that of Rayleigh is discussed. W. R. A.

Atmospheric [light] absorption. II. (MME.) A. VASSY and E. VASSY (J. Phys. Radium, 1939, [vii], **10**, 403—412; cf. A., 1939, I, 167).—Data obtained on the total atm. absorption and on the absorption by the lower atm. are presented as curves which express the optical density of 1 km. of air at n.t.p. as a function of λ. The selective absorption of various constituents of the atm. has been investigated, and some principal bands have been identified.

Three bands previously unknown have been attributed to H_2O vapour. The mol. diffusion has been determined accurately, and the absorption law of Rayleigh and Cabannes verified. W. R. A.

Molecular spectrum of thallous chloride. E. MIESCHER (Helv. Phys. Acta, 1939, **12**, 296—297).—Data are recorded for a series of bands on the long-λ side of the TlCl $1-^1\Sigma^+$ spectrum, of abnormally great intensity and with an abnormal isotope effect. The bands are associated with a common upper level and the levels v'' 8—14 of the ground state. The bands show the isotope effect ^{203}Tl, ^{205}Tl, but not the Cl isotope doublet. L. J. J.

Biological detectors for the spectral analysis of rays emitted by rock-salt after irradiation with X-rays. M. V. FILIPPOV (Acta Physicochim. U.R.S.S., 1939, **10**, 725—728).—The rays (1900—2500 A.) emitted from rock-salt crystals after irradiation with X-rays have been investigated, using the biological method previously described (A., 1939, I, 24). The results agree with those obtained by Kudrjavzeva (A., 1934, 1155) with a photo-electric counter. A. J. M.

Structure of the tetrachloroethylene molecule. J. DUCHESNE and M. PARODI (Nature, 1939, **144**, 382; cf. A., 1938, I, 494).—The absorption curve near 30 μ. for C_2Cl_4 in paraffin shows two bands at 387 and 332 cm.$^{-1}$, in agreement with the theoretical vals. The val. of the C≡C force const. may be $\leqslant 8.5 \times 10^5$ dynes per cm. and the suggested structure arising from resonance between the C:C linkings is not to be excluded. L. S. T.

Infra-red studies of some glycols and ethoxy-alcohols. F. T. WALL and W. F. CLAUSSEN (J. Amer. Chem. Soc., 1939, **61**, 2679—2683).—Infra-red absorption spectra near 2·8 μ. have been measured for CCl_4 solutions of $OEt \cdot [CH_2]_n \cdot OH$ ($n = 1$—5), and the following glycols : ethylene, propylene, butylene, penta-, hexa-, deca-, and octadeca-methylene. Results for the glycols are difficult to interpret but there is some evidence of H-bonding. Ethoxy-alcohols associate by forming intermol. H-bonds; $OEt \cdot [CH_2]_3 \cdot OH$ and $OEt \cdot [CH_2]_4 \cdot OH$ form rings. W. R. A.

Infra-red absorption studies. VIII. Hydrazoic acid. A. M. BUSWELL, G. W. McMILLAN, W. H. RODEBUSH, and F. T. WALL (J. Amer. Chem. Soc., 1939, **61**, 2809—2812).—DN_3 was prepared by shaking a CCl_4 solution of HN_3 with D_2O and 75—80% conversion resulted. The infra-red absorption of HN_3 and DN_3 has been investigated and vv assigned to the vibrations of groups in the mols. HN_3 shows no evidence of association through N–H→N bonding but certain peculiarities in the vv associated with linkings containing H are attributed to the non-linear character of HN_3. The high solubility in Et_2O is attributed to N–H→O bonding. There is some evidence of N–D→N bonding. W. R. A.

Infra-red absorption spectra of some carboxylic acids and of dibenzoylmethane and related molecules. F. T. WALL and W. F. CLAUSSEN (J. Amer. Chem. Soc., 1939, **61**, 2812—2815).—The infra-red absorption between 2·5 and 5·0 μ. has been

recorded for CCl_4 solutions of AcOH, AcOD, $EtCO_2H$, $EtCO_2D$, BzOH, BzOD, azelaic (I) and diethylmalonic (II) acids, CH_2Bz_2, CH_2Ph_2, and Bz_2. For the monobasic "light" acids the absorption between 3 and 4 μ. arises from H-bonds and deuteration diminishes this absorption considerably. Curves for (I) and (II) are similar to that for $EtCO_2H$. The data for CH_2Bz_2 suggest that it undergoes enolisation followed by H-bonding.   W. R. A.

Effects of alkali halides on the 4·7 μ. water band. T. N. GAUTIER and D. WILLIAMS (Physical Rev., 1939, [ii], **56**, 616—617; cf. Plyler and Barr, A., 1938, I, 385).—Measurements are reported and discussed for the effects of LiCl, NaCl, KCl, RbCl, KF, KBr, and KI on the absorption coeff. of H_2O at the position of max. absorption in the 4·7 μ. association band. Vals. of the relative polarising powers of the various ions are given, and results are discussed with reference to the Bernal–Fowler theory of liquid H_2O.   N. M. B.

Elementary processes in the sensitised fluorescence of OH molecules. (MISS) E. R. LYMAN (Physical Rev., 1939, [ii], **56**, 466—470; cf. A., 1938, I, 226).—The processes involved were investigated by photometric measurements of the intensities of lines of the (0, 0), (1, 0), and (1, 1) OH bands. Collisions between metastable $^3P_0$ Hg atoms and H_2O mols. produce unexcited OH mols., which are then excited by further collisions with $^3P_0$ Hg atoms to levels with energies $\ll$ the energy of the $^3P_0$ Hg atoms. Abnormal rotational energy is produced in the excitation of the OH mols. Collisions between N_2 and OH mols. transform vibrational energy of the OH mols. into rotational energy, and also reduce the rotational energy of the OH mols. towards thermal vals. Collisions between He and OH mols. are much less effective in transferring energy.   N. M. B.

Fluorescence of the CN radical from the photodissociation of cyanogen molecules. A. V. JAKOVLEVA (Acta Physicochim. U.R.S.S., 1939, **10**, 433—440).—$(CN)_2$ vapour, when subjected to irradiation in the Schumann region (H_2 discharge tube), dissociates with the emission of blue bands of the CN radical. The temp. corresponding with the amount of rotational energy of the CN radical, calc. by the formula previously given (A., 1939, I, 178), is 1500° K. Comparison with data on the dissociation of ICN indicates that the CN radical possesses in both cases the same amount of rotational and vibrational energy. The influence of collisions with foreign gas mols. (A, N_2, CO) on the fluorescence of the CN radical due to photodissociation has been investigated. Such collisions cause an increase in the amount of rotational energy depending on the mass of the foreign mol.   W. R. A.

Simplification of the fluorescence spectrum of HgBr by addition of foreign gases. K. WIELAND (Helv. Phys. Acta, 1939, **12**, 295—296).—In the presence of 400 mm. of N_2, the lower vibrational terms in the fluorescence spectrum of HgBr from 5100 to 3900 A. are favoured at the expense of the higher terms to such an extent that the band series corresponding with $v' = 0$, which in the absence of foreign

gas is scarcely visible, has max. intensity, while vibrational terms $> v' = 11$ are not observed.   L. J. J.

Influence of ionic strength on the quenching of fluorescence in aqueous solutions. R. W. STOUGHTON and G. K. ROLLEFSON (J. Amer. Chem. Soc., 1939, **61**, 2634—2638).—The quenching consts. have been determined at various ionic strengths for the quenching of the fluorescence of quinine sulphate by KCl, KBr, and $AgNO_3$; fluorescein by KI in acid and basic solutions; acridone by KI and $AgNO_3$; anthracenesulphonic acid by KI and $AgNO_3$; acridonesulphonic acid by KI, KCNS, and $AgNO_3$. Measurements of absorption on the dye solutions, in presence and absence of quenching ions, exclude the possibility of complex formation between the dye and the quencher. The quenching appears to arise from a bimol. reaction between the quenching ion and the activated dye mol.   W. R. A.

Light output and secondary emission characteristics of luminescent materials. S. T. MARTIN and L. B. HEADRICK (J. Appl. Physics, 1939, **10**, 116—127).—Light output (L), c.d., and persistence characteristics of willemite, ZnS, $CaWO_4$, and other silicate and sulphide phosphors are analysed. L has been obtained as a function of beam c.d. and of screen voltage at const. c.d. The sulphides and $CaWO_4$ have a much shorter persistence than the silicates. Approx. $L = Af(i).V^n$ ($i = $ c.d., $V = $ electron energy at the screen, $A = $ const.). For willemite and other silicates n is < 2, for sulphides $n = 2$, and for $CaWO_4$ and a fused layer of willemite n is > 2. The abnormality of willemite when fused is discussed.   C. R. H.

Structure of p-diphenylbenzene and its Raman spectrum. S. K. MUKERJI and L. SINGH (Nature, 1939, **144**, 382—383; cf. A., 1938, I, 555).—24 new lines for solid p-$C_6H_4Ph_2$ (I) are recorded. Comparison with the Raman spectrum of Ph_2 supports the view (A., 1933, 1235) that the mol. of (I) is planar.   L. S. T.

Raman effect of pyrone compounds and electronic resonance. M. V. VOLKENSTEIN and J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1939, **10**, 677—706).—The Raman spectra of 2 : 6-dimethylpyrone (I), coumarin (II), xanthone, coumarone, and dioxan, and oxonium compounds of (I) with HCl and HBr and of (II) with HCl have been investigated. The addition of a H halide produces no considerable effect on the spectrum of (I), thus indicating that there is no O^{IV} in these oxonium compounds. The Raman spectrum of (II) resembles those of $C_{10}H_8$ and coumarone. The effect of electronic resonance on the Raman spectrum is discussed with particular reference to the CO group. The oxonium bond is a result of intermol. interaction stabilised by the presence of a resonance state in the form of the H bond. The dipole moments of (I) and xanthone are calc. from the frequencies of oscillation of the CO group, which are $<$ normal in these compounds.   A. J. M.

Raman spectra of nitric acid in solution in ether and chloroform. J. DESMAROUX, J. CHÉDIN, and R. DALMON (Compt. rend., 1939, **209**, 455—457).—The Raman spectra of HNO_3 and 30% solu-

tions in Et_2O and $CHCl_3$ are compared. The lower w vary only slightly, but the 3300 cm.$^{-1}$ OH band is absent in the Et_2O solution. The latter contains mols. in which $H\overset{..}{N}O_3$ is co-ordinated by its H atom to the ether O (cf. A., 1939, 1, 517). A. J. E. W.

Determination of dipole moments in solution. D. J. DAVAR (Current Sci., 1939, **8**, 414—416).— It is suggested that the total polarisation P_2 of a solute in different solvents should not be extrapolated to $\epsilon = 1$ for the solvent, since it is likely that the extrapolation is justified only for the liquid state; the graph of P_2 against $(\epsilon - 1)/(\epsilon + 2)$ should become horizontal where the transition from the liquid to the gaseous state occurs. The corresponding transition dielectric const. ϵ_θ is given by $\epsilon_t = \epsilon_c + (d\epsilon/d\theta)(0 - T_c)$, where ϵ_c is the val. at the crit. temp. T_c. For C_6H_6 solutions at room temp. $\epsilon_0 = 1\cdot88$ and extrapolation to this val. brings the differing results of Parts (A., 1931, 669) and of Groves and Sugden (A., 1937, I, 115) for some alkyl halides into good agreement. Similarly by taking a mean val. of $\epsilon_\theta = 1\cdot7$ for a variety of solvents, the differing results of several authors for the nitrotoluenes have been brought into line. T. H. G.

Alleged geometrical isomerism in certain anils, and dipole moment of phenanthridine. V. DE GAOUCK and R. J. W. LE FÈVRE (J.C.S., 1939, 1392—1394; cf. A., 1938, II, 280).—Dielectric consts. and density of C_6H_6 solutions are determined for the yellow and red forms of p-homosalicylidene-aniline. Dipole moments μ ($\sim 2\cdot93$ D.), also $[R_L]_D$, are the same for both forms; their differences are thus presumably due to dimorphism and not to geometrical isomerism of the Hantzsch–Werner type. Similar results are obtained with yellow and red forms of Et salicylidene-p-aminobenzoate ($2\cdot69$ D.). Phenanthridine (I) has μ $1\cdot5_0$ (calc. $1\cdot6$), in agreement with its cis-structure; it is suggested that NPh:CHPh normally has a $trans$-structure, and that only at $>700°$ [when (I) is first obtained pyrogenically] does this change to cis. CPh_2:NPh has μ $2\cdot0_3$ D. E. W. W.

Parachor, dipole moment, and molecular refraction of selenophen. B. TAMAMUSHI, H. AKIYAMA, and S. UMEZAWA (Bull. Chem. Soc. Japan, 1939, **14**, 310—317).—C_4H_4Se has d_4^{25} $1\cdot6003$, n_D^{25} $1\cdot57689$, $[R]_D$ $27\cdot12$, σ_{25} $36\cdot05$ dynes per cm., $[P]$ $200\cdot6$, μ $0\cdot78$ D. (in C_6H_6) and $0\cdot77$ D. (in C_6H_{14}). L. J. J.

Dipole moment and structure of the isomeric selenophthens. B. TAMAMUSHI, H. AKIYAMA, and S. UMEZAWA (Bull. Chem. Soc. Japan, 1939, **14**, 318—322).—The two $trans$-forms of $C_6H_4Se_2$ are solids with m.p. 51—51·5° and $\mu = 0$; m.p. 123—124·5° and $\mu = 1\cdot07$ D., respectively, and the cis-form is a liquid with b.p. 90—93°/14 mm. and $\mu = 1\cdot52$ D. L. J. J.

Molecular rotation and polymorphism in the tert.-butyl halides. W. O. BAKER and C. P. SMYTH (J. Amer. Chem. Soc., 1939, **61**, 2798—2805).— The polymorphism exhibited by $Bu^\gamma X$ ($X = Cl$, Br, I) has been studied thermally, optically, and by dielectric const. The observed dispersion, hysteresis, and supercooling effects are interpreted in terms of

possible mol. processes. Supercooling is evident in solid state transitions of the first kind when the val. of ΔG between the metastable and stable phases below the transition is relatively small, and dielectric measurements indicate that it may be a function of the ordering ability of the mols. in the stable form. Results with the polarising microscope suggest a correlation of lattice symmetry with the mol. rotational freedom. It is also suggested that the isotropic lattices found previously for many org. mols. above the polymorphic transitions are associated with the development of rotational freedom at these transitions. Rotational " premelting " before a solid state transition is analogous to the premelting of solids near the m.p. W. R. A.

Magnetic rotatory power of deuterobenzene and deuterethyl deuteralcohol. Thermal variation. C. FERT (Compt. rend., 1939, **209**, 479—480).—Vals. of the Verdet const. (λ 5461 A.) are recorded for C_6D_6 ($0\cdot03643$—$0\cdot03292$ at $6\cdot8$—$71°$) and $C_2D_5\cdot OD$ ($0\cdot01330$—$0\cdot01221$ at $2\cdot3$—$70\cdot5°$). The vals. at $20°$ are $0\cdot03569$ and $0\cdot01304$, respectively. A. J. E. W.

Rotatory magnetic dispersion of heavy benzene (C_6D_6) and heavy [ethyl] alcohol ($C_2D_5\cdot OD$). G. DUPOUY (Compt. rend., 1939, **209**, 453—455).—The following rotation vals. are obtained at 5461 A.: C_6D_6, $35\cdot20°$, $32\cdot24°$ at temp. of $16\cdot5°$ and $71°$; $C_2D_5\cdot OD$, $13\cdot3°$, $11\cdot97°$ at temp. of $2°$ and $70°$. Relative vals. of the dispersion at 4358, 4916, 5780, and 5893 A. are also given; no variation with temp. is detected. A. J. E. W.

New electro-optical effect. H. MUELLER and B. W. SAKMANN (Physical Rev., 1939, [ii], **56**, 615—616; cf. A., 1939, I, 318; Norton, $ibid.$, 318).— Previous results on the dependence on concn. and particle size are confirmed for monodisperse sols. New data on the dependence of the birefringence on strength and frequency of the electric field in a monodisperse bentonite sol of average particle radius 29 mμ. and concn. $0\cdot61\%$ are reported. At low frequencies the behaviour is anomalous; the negative birefringence for small fields reaches a max. and the Kerr effect becomes positive above a crit. field strength. This result is analogous to that observed in the Majorana effect in colloidal " Bravais-Iron," and is believed to be the electric analogue of this magneto-optical effect. Explanations are discussed. N. M. B.

Interrelation of dissociation energy and internuclear distance for some simple di-atoms in ground states. C. H. D. CLARK (Nature, 1939, **144**, 285—286).—For ground states of simple di-atoms of related type, $e.g.$, LiLi, NN, and OO, $x = Dr_e^3 n^{1/2}$ (cf. A., 1939, I, 455), where n is group no., tends to constancy. Other functions involving bond const. and internuclear distance, r_e, are discussed. L. S. T.

Application of the cage theory of liquids to the problem of ion mobilities. J. J. HERMANS (Rec. trav. chim., 1939, **58**, 917—927).—The theory of Polissar (A., 1939, I, 82) is discussed and certain modifications are proposed. In the region under discussion neither classical nor quantum mechanics

is strictly valid, and so the equation $\nu = (1/2a) \times \sqrt{(3kT/m)}$ (1) (ν = frequency of oscillation, m = mass, and a = mean free path of an ion) can give only the order of magnitude. Instead the equation $\nu = 6kT/h$ is used (reasons for the use of the factor 6 being given) and with this the temp. coeff. of the mobility is calc. for a no. of ions, in agreement with observation. With the $H^{\cdot}$ and OH' ions the agreement is poorer, as is to be expected, since for a proton the smallest cage is much larger than itself, and the potential energy has a min. near the walls of the cage instead of in the middle as for other ions. Application of equation (1) leads to results of the correct order of magnitude.   F. J. G.

Structure of boron hydrides. II. L. E. AGRONOMOV (J. Gen. Chem. Russ., 1939, **9**, 1389—1393).—Schlesinger's compound $B_2H_6,2NH_3$ (A., 1938, I, 207) should, on grounds of the electronic theory, be considered as being BH_3,NH_3.   R. T.

Value of the co-ordination number and the chemical formulæ of complex compounds. B. ORMONT (Acta Physicochim. U.R.S.S., 1939, **11**, 87—96; cf. A., 1939, I, 61).—A method of writing formulæ which is capable of representing the structure of complex compounds both in the cryst. state and in solution is proposed.   O. D. S.

Extended co-ordination theory of valency. III. Valency bonds in carbon compounds. R. TSUCHIDA and M. KOBAYASHI (Rev. Phys. Chem. Japan, 1939, **13**, 61—73; cf. A., 1939, I, 358).—In the extended theory of valency, all C compounds are assumed to be formed by co-ordinating ions and mols. around the $C^{\cdots}$ cations. The types of linkages present (tetrahedral, trigonal, aromatic, digonal, double, triple) depend on the no. and nature of the groups. The nature of these bonds in C compounds is discussed quantum-mechanically.   W. R. A.

Coriolis coupling terms in polyatomic molecules. H. A. JAHN (Physical Rev., 1939, [ii], **56**, 680—683; cf. A., 1939, I, 119, 300, 552).—Mathematical. A method is given for determining, from the displacement vectors of the normal modes of vibration of any polyat. mol., which normal modes are coupled by Coriolis forces when the mol. rotates. The method is illustrated by reference to H_2O, CH_2O, C_2H_4, and CO_2 mols.   N. M. B.

Size and shape of molecular swarms in anisotropic liquids. V. ZVETKOV (Acta Physicochim. U.R.S.S., **11**, 97—106).—Theoretical. Measurements of η of azoxyanisole in a rotating magnetic field show that groups of mols. (diameter of group 7×10^{-5} cm.) execute a disordered rotational movement of $\sim 1°$.   O. D. S.

Friction. G. W. HAMMAR and G. MARTIN (Science, 1939, **90**, 179—180).—Experiments described indicate that a large fraction of the static friction between two clean, smooth glass surfaces in contact is due to mol. attraction between parts of the surfaces which are so close that mol. adhesions come into play.   L. S. T.

Temperature dependence of Lindemann frequency. L. SIBAIYA and M. R. RAO (Current Sci., 1939, **8**, 359).—Combination of the expression already deduced for γ (A., 1939, I, 406) with Eötvös' rule gives expressions for the variation of the Lindemann frequency, compressibility, η, and γ with temp. in terms of a new reduced temp. $(T_c - T)/(T_c - T_f)$, where T_f is the m.p.   L. J. J.

Effect of temperature on the intensity of X-ray reflexions from copper. G. W. BRINDLEY and G. H. ATKINSON (Nature, 1939, **144**, 477; cf. A., 1939, I, 50).—Examination of the intensities of reflexions from Cu at room and liquid air temp. gives for the Debye characteristic temp. of Cu a val. in agreement with that obtained from sp. heat data.   L. S. T.

Effect of temperature on the intensity of X-ray reflexions from gold. E. A. OWEN and R. W. WILLIAMS (Nature, 1939, **144**, 477—478).—Results obtained previously on Cu (A., 1939, I, 50) may be invalidated by tarnishing and need further investigation (cf. preceding abstract). The characteristic temp. for Au, kept at 445° K., deduced from X-ray measurements agrees with that found by other methods.   L. S. T.

Fine structure of the dark–light X-ray diffraction line obtained by convergent X-rays. T. FUJIWARA (J. Sci. Hirosima Univ., 1939, **9**, 233—239). —Using the improved method of convergent X-rays (*ibid.*, 115), radiographs have been obtained with a thin single-crystal of rock-salt. In addition to light and dark diffraction lines, many " dark–light " diffraction lines are exhibited and appear in pairs, with the side close to the centre of curvature of each line light and the opposite side dark. The reason for the existence of these lines is discussed.   W. R. A.

Theory of the diffuse scattering of X-rays by crystals in the region of the *K* critical absorption wave-length. G. E. M. JAUNCEY (Physical Rev., 1939, [ii], **56**, 644—651).—Mathematical.   N. M. B.

X-Ray dispersion and atomic electron cloud distortion in zinc crystals. E. M. McNATT (Physical Rev., 1939, [ii], **56**, 406—413).—Monochromatic X-rays of λ 1·54 (Cu $K\alpha$) and 1·433 A. (Zn $K\alpha$) were diffusely scattered at angles ϕ (24—120°) from single crystals of Zn ($\lambda_K = 1·28$ A.) with orientation angles ψ 0 and 90°. The intensity of the diffusely scattered rays varied with $(\sin \frac{1}{2}\phi)/\lambda$ as on Jauncey's formula close to the K crit. absorption λ of the scattering crystal. For Cu $K\alpha$ rays the decrement Δf of the at. structure factor is 2·5 (cf. Hönl's val. 2·3); the corresponding val. for Zn $K\alpha$ rays is 3·65 (2·8). A dip in the diffuse scattering ($\psi = 0°$) is due to a corresponding dip in the at. structure factor f ($\psi = 0°$) in the same region. The max. difference f ($\psi = 90°$) $- f$ ($\psi = 0°$) is ~ 6 electrons compared with the former val. 2·4 electrons, and indicates a larger and deeper distortion of the electron cloud of a Zn atom in the crystal than previously imagined.   N. M. B.

Allotropy of arsenic. H. STÖHR (Z. anorg. Chem., 1939, **242**, 138—144).—X-Ray measurements confirm the rhombohedral structure of cryst. As (α-form); a 4·123$\pm$0·008 A., $d_{calc.}$ 5·78. Three amorphous forms of As (β, γ, δ) obtained by sublimation under various conditions are also described. The following vals. of $\chi_{at.}$ ($\times 10^6$) are recorded : α $-5·5\pm1$

$(20°)$, $+1\pm1.5$ $(-183°)$; β -23.7 $(20°)$, -22.6 $(-183°)$; γ -23.0 $(20°)$, -22.4 $(-183°)$; δ -23.0 $(20°)$, -22.8 $(-183°)$. The vals. of d_4^{25} are: α 5.73 ± 0.01; β 4.73 ± 0.01; γ 4.97, 5.01, 5.04; δ 5.07, 5.07, 5.18.　　　　　　　　　　O. J. W.

Recrystallisation diagram of antimony. J. CZOCHRALSKI and E. PRZYJEMSKI (Wiadom. Inst. Met., 1936, 3, 113—115; Chem. Zentr., 1937, i, 2740).—The recrystallisation diagram of Sb cylinders, worked at room temp. (decrease of length 1—70%) and heated for 30 min. at 300—610°, shows a sharp max. of grain size for heating at 610°.　　　　　A. J. E. W.

X-Ray examination of the structure of boron nitride. A. BRAGER (Acta Physicochim. U.R.S.S., 1939, 10, 902; cf. A., 1938, I, 605).—A correction. The space-group of the BN structure is C_{6v}^4 and not C_{3h}^1.　　　　　　　　　　O. J. W.

X-Ray examination of titanium nitride. II. Structure of some intermediate products formed when obtaining titanium nitride. A. BRAGER (Acta Physicochim. U.R.S.S., 1939, 10, 887—902).— β-$TiCl_4,4NH_3$ (prepared at $-30°$ and heated to $20°$) is cubic, with a 7.72 A., 2 mols. per unit cell, probable space-groups D_{2d}^9, D_{2d}^{11}, D_{4h}^{17}, C_{4v}^9. α-$TiCl_4,4NH_3$ (prepared by heating the β-form to $200°$) is cubic, with a 3.86 A., $\frac{1}{4}$ mol. per unit cell, space-groups the same as for NH_4Cl. The at. positions are given for both substances. $TiCl_2(NH_2)_2$ is cubic, with a 3.86 A., $\frac{1}{2}$ mol. per unit cell.　　　　　O. J. W.

Isotope effect in potassium dihydrogen phosphate. A. R. UBBELOHDE and (MISS) I. WOODWARD (Nature, 1939, 144, 632).—Repeated crystallisation of KH_2PO_4 from 99·6% D_2O gives a new cryst. form probably identical with tetragonal KD_2PO_4. The crystals are monoclinic with a_0 7.37, b_0 14.73, c_0 7.17 A. (all ±0.01 A.), β $92.0°$, and 8 mols. per unit cell. Further evidence of the difference between H and D linkings in crystals is thus afforded.　　　L. S. T.

Structure of potassium molybdocyanide dihydrate. Configuration of the molybdenum octacyanide group. J. L. HOARD and H. H. NORDSIECK (J. Amer. Chem. Soc., 1939, 61, 2853—2863).—Crystals of potassium molybdocyanide dihydrate, $K_4Mo(CN)_8,2H_2O$, belong to the orthorhombic system, containing four mols. per unit cell, a 16.55, b 11.70, c 8.68 A.; space-group D_{2h}^{16}—$Pnma$. Parameters and interat. distances are given. The $Mo(CN)_8''''$ ion approximates to the symmetry of the point-group D_2^d—$\overline{4}2m$.　　　W. R. A.

Crystal structure of cæsium fluorochromate. J. A. A. KETELAAR and E. WEGERIF (Rec. trav. chim., 1939, 58, 948).—$CsCrO_3F$ is isomorphous with $KCrO_3F$ (A., 1939, I, 12) and has a 5.715, c 14.5 A.; space-group C_{4h}^6; 4 mols. in the unit cell.　　　F. J. G.

Crystal structures of rubidium and cæsium sesquioxides. A. HELMS and W. KLEMM (Z. anorg. Chem., 1939, 242, 201—214).—X-Ray measurements give no evidence of an oxide K_2O_3. Rb and Cs form the oxides Rb_4O_6 and Cs_4O_6, which have a cube-centred lattice. Magnetic evidence indicates that these oxides contain one O_4'' and two O_2' ions. The prep. of the oxides is described.　　　O. J. W.

Redetermination of the fluorine—fluorine distance in potassium hydrogen fluoride. L. HELMHOLZ and M. T. ROGERS (J. Amer. Chem. Soc., 1939, 61, 2590—2592).—Using Laue and oscillation photographs the redetermined val. of the parameter in KHF_2 yields 2.26 ± 0.01 A. for the F—F distance in $(F-H-F)'$ ions. This val. is 0.29 ± 0.06 A. $<$ that for the polymerides of gaseous HF and indicates that formation of additional H-bonds increases the F—F distance.　　　　　W. R. A.

Structures of complex fluorides. Potassium hexafluogermanate and ammonium hexafluogermanate. J. L. HOARD and W. B. VINCENT (J. Amer. Chem. Soc., 1939, 61, 2849—2852).—$(NH_4)_2GeF_6$ and K_2GeF_6 are isomorphous, having a one-mol. hexagonal unit with a 5.85, 5.62; c 4.775, 4.65 A., respectively, space-group D_{3d}^3—$C3m$. The structure consists of an aggregate of the univalent cations and approx. regular octahedral anions GeF_6'''' with Ge—F distance 1.77 A. Each cation is surrounded by nine nearly equidistant F atoms and three others at a greater distance. This hexagonal structure (I) is preferred to the cubic $(NH_4)_2PtCl_6$ structure (II). Crystals of Rb_2GeF_6 are hexagonal but do not have either structure (I) or (II). They contain two mols. per unit cell, a ∼5.96, c ∼9.72 A., and Rb· appears to have a co-ordination no. of 12.　　　W. R. A.

Crystallographic study of the double copper potassium bromide. A. SILBERSTEIN (Compt. rend., 1939, 209, 540—542).—$KCuBr_3$ is obtained as black monoclinic-holohedral needles, d 3.92, by evaporating an aq. solution of KBr and excess of $CuBr_2$. The unit cell (a 4.28, b 14.43, c 9.71 A., β $108°$ $23'\pm10'$) contains 4 mols.; space-group, C_{2h}^2—$P2_1/m$.　　　　　A. J. E. W.

Structure of copper cyanide complexes. I. Structure of the double copper cobalt and copper chromium cyanides. M. A. ROLLIER and E. ARREGHINI (Gazzetta, 1939, 69, 499—508).—X-Ray measurements give a cubic structure, space-group O_h^5, for $Cu_3[Co(CN)_6]_2$ (I) (a 9.91 ± 0.05 A., $Z=2$) and for the unstable $Cu_2Cr(CN)_6$ (a 10.22 ± 0.05 A., $Z=4$). The prep. of these compounds is described. The magnetic susceptibilities of $Cu_2Fe(CN)_6$, $CuK_2Fe(CN)_6$, and of (I) have been measured. The vals. of μ_{eff}. in Bohr magnetons are 1.86, 1.81, and 1.91, respectively, indicating that all three substances contain Cu^{II}. The structure of complex cyanides is discussed.　　　　　O. J. W.

Structure of bridged dipalladium derivatives. —See A., 1939, II, 536.

Molecular symmetry of monoisopropyl tritert.-butyl tetrathioorthosilicate. H. A. KLASENS and H. J. BACKER (Rec. trav. chim., 1939, 58, 941—947; cf. A., 1935, 326, 1111).—$NaSPr^\beta$ and $SiCl(SBu^\gamma)_3$ give SPr^β·$Si(SBu^\gamma)_3$; the crystals are tetragonal and isomorphous with those of $Si(SBu^\gamma)_4$, $Ge(SBu^\gamma)_4$, or $Sn(SBu^\gamma)_4$ (cryst. form and physical consts.; cf. A., 1933, 1274). RBu^γ groups are in tetrahedral arrangement about the central atom. Theoretical aspects are discussed.　　　　　A. T. P.

Space groups of p-nitrophenol (metastable), phenacetin, and tribenzylamine. M. PRASAD, J.

SHANKER, and P. N. BALJEKAR (J. Indian Chem. Soc., 1939, **16**, 357—363).—Crystals of p-$NO_2 \cdot C_6H_4 \cdot OH$ (metastable) (I), phenacetin (II), and $N(CH_2Ph)_3$ (III) belong to the monoclinic prismatic class, space-group C_{2h}^5, four asymmetric mols. per unit cell. The following vals. are recorded for (I), (II), and (III), respectively : a, 15·34, 13·78, 22·03; b, 11·15, 9·73, 8·92; c, 3·79, 7·82, 9·04 A.; ρ, 1·495, 1·202, 1·074.
W. R. A.

Stereoisomerides of γ-amino-β-hydroxybutyric acid and of *iso*serine.—See A., 1939, II, 495.

X-Ray investigation of the decamethylene series of polyesters. C. S. FULLER and C. J. FROSCH (J. Amer. Chem. Soc., 1939, **61**, 2575—2580).—X-Ray fibre patterns have been obtained for oriented fibres of decamethylene polyesters of oxalic, succinic, glutaric, adipic, suberic, azelaic, and sebacic acids. Measurements of these patterns indicate mols. of approx. planar zig-zag form. For all except the oxalic ester, the structures conform to the same lateral packing as the lower mol. chain compounds. For some esters the presence of different crystal forms is indicated, and a general qual. interpretation of these forms is given on the basis of Schoon's theory (A., 1938, 1, 348). The origin of the different fibre patterns is discussed. W. R. A.

X-Ray and thermal examination of unsymmetrical mixed triglycerides.—See A., 1939, II, 531.

Structure of insulin. M. L. HUGGINS (J. Amer. Chem. Soc., 1939, **61**, 2982).—If an electron density projection of insulin is made, using Crowfoot's $hk0$-X-ray data and assuming that the true projection has a centre of symmetry and that the structure proposed by Wrinch and Langmuir permits determination of the signs of the structure factors, the fit obtained by superimposing a projection of Wrinch's "C_2 octahedron" is fairly satisfactory and the cage or ring mol. hypothesis may be correct. If, however, it is assumed that the mol. is composed of six point atoms at the corners of a regular octahedron the resultant projection does not indicate a cage structure.
W. R. A.

Electron diffraction investigation of the molecular structures of ethyl chloride, ethyl bromide, *iso*propyl chloride, *iso*propyl bromide, methylchloroform, and *iso*crotyl chloride. J. Y. BEACH and D. P. STEVENSON (J. Amer. Chem. Soc., 1939, **61**, 2643—2651).—An electron diffraction investigation of EtCl (I), EtBr (II), Pr$^\beta$Cl (III), Pr$^\beta$Br (IV), $CMeCl_3$ (V), and CMe_2:CHCl (VI) has yielded the following data : C—Cl distance, 1·76±0·02 (I) and (V), 1·75±0·03 (III), 1·72±0·02 (VI); C—Br, 1·91± 0·02 (II), 1·91±0·03 A. (IV); C–C–Cl angle, 111° 30′±2° (I), 109±3° (III), 109±2° (V), 123±2° (VI); C–C–Br angle, 109±2° (II), 109° 28′±3° (IV). The C—H bond distance was assumed to be 1·09 A. as found for CH_4. The C–C–Cl angle in (V), as in Bu$^\gamma$Cl (A., 1938, 1, 181), is < the tetrahedral val., indicating that the electrostatic repulsion of like groups and the attraction of unlike groups determines the direction of the distortion of the bond angles from the tetrahedral val. The steric repulsions between attached groups in these mols. must be approx. equal. The

shortening of 0·04 A. of the C–Cl bond in (VI) is due to the effect of an adjacent double linking. W. R. A.

Molecular structure of acetaldehyde. D. P. STEVENSON, H. D. BURNHAM, and V. SCHOMAKER (J. Amer. Chem. Soc., 1939, **61**, 2922—2925).—Electron diffraction investigation of MeCHO has given the following data : C—C distance, 1·50±0·02 A.; C—O, 1·22±0·02 A.; C–C–O angle, 121±2°. The val. for the C=O distance is in good agreement with those obtained previously for CH_2O (A., 1939, I, 554) and for glyoxal, and the mean val. is 1·21±0·02 A., which is the val. deduced from other methods. An explanation of the shortening of the C—C bond distance from 1·54 to 1·50 A. is suggested. W. R. A.

Colour and magnetic properties of manganous sulphide. S. S. BHATNAGAR, B. PRAKASH, and J. SINGH (J. Indian Chem. Soc., 1939, **16**, 313—320).—Different samples of pink MnS have the same magnetic consts., $\chi = 41·85 \times 10^{-6}$ at 34°, magneton no. 5·95 — 6·02 agreeing with the theoretical Van Vleck val. of 5·92 for $Mn^{..}$. Pink MnS is, in general, a mixture of two crystal modifications (A., 1933, 341), and the constancy of χ for different samples indicates that both modifications have the same χ. Consequently change in crystal structure cannot explain the divergence between the vals. of χ for pink MnS and green MnS ($\chi = 64·15 \times 10^{-6}$, magnetic moment 5·99— 6·01), which is of the NaCl lattice type. The cause of this divergence and the difference in colour may be due to differences in the type of linkings involved in the two instances. W. R. A.

Magnetic susceptibilities of metallic oxides, with special reference to those of chromium and manganese. S. S. BHATNAGAR, A. CAMERON, E. H. HARBARD, P. L. KAPUR, A. KING, and B. PRAKASH (J.C.S., 1939, 1433—1441).—Application of the Curie law to the best recorded vals. of the magnetic susceptibility, χ, of compounds of the transition metals gives poor results, but Weiss' modification of this law applied to the oxides of Cr and Mn gives vals. for the magnetic moments which agree with theory. Thus magnetic measurements can be used to find the structure of oxides, and the occurrence of $Cr^{....}$ in a hydrated oxide is established. The decomp. of CrO_3, with variation of composition in non-stoicheiometric oxides, does not produce an appreciable effect on χ. The χ of Cr_2O_3 depends to a slight extent on the method of prep., probably due to the presence of impurities and to traces of chemisorbed gases. This view is supported by the fact that adsorption of O_2 or H_2 at 440° on Cr_2O_3 causes χ to vary, and high-temp. evacuation also produces a decrease in χ. Activated adsorption on oxides may be connected with the reduction of chemisorbed O_2, and the use of magnetic measurements for following surface chemical processes on oxides is recommended. Magnetic measurements favour the formulæ $O:Mn \cdot O \cdot Mn:O$ (Mn_2O_3), $Mn:O$ (MnO), and $O:Mn:O$ (MnO_2).
W. R. A.

Principal magnetic susceptibilities of tellurium crystal. S. R. RAO and S. R. GOVINDARAJAN (Current Sci., 1939, **8**, 414).—Crystals prepared by slow cooling have susceptibilities of $-0·329 \times 10^{-6}$ parallel to the trigonal axis and $-0·296 \times 10^{-6}$

perpendicular to it. On heating, the former falls and the latter remains const. until they become equal at 220°. On melting at 450° the vol. susceptibility falls from -1.7×10^{-6} to -0.3×10^{-6}. Small amounts of Sn, Cd, Bi, or Pb reduce the diamagnetic susceptibilities by amounts which increase as the radius of the impurity element increases but are independent of the no. of valency electrons in the latter. The linkages of the six valency electrons in polycryst. Te are probably not metallic and the element is non-metallic from the magnetic point of view. This contention is supported by the high resistivity of the element. T. H. G.

Formula for the change of velocity of sound with temperature. A. E. BATE (Nature, 1939, **144**, 479).—Between $-40°$ and $100°$, $v = 331.5 + 0.560$, where v is the velocity in m. per sec. at $0°$.
L. S. T.

Relation between refraction coefficients of higher fatty acids, temperature, and their degree of unsaturation. V. J. ANOSOV and G. B. RAVITSOH (Compt. rend. Acad. Sci. U.R.S.S., 1939, **22**, 496—498).—Data on n_D for oleic, linoleic, and linolenic acids at 20—40° are given. n is a linear function of temp. and the I val. F. J. G.

Dependence on temperature of the refractive power of crystallised cellulose. A. FREY-WYSSLING and K. WUHRMANN (Helv. Chim. Acta, 1939, **22**, 981—988).—Vals. of n_o and n_e for the F, D, and C lines over the temp. range 3.0—50.5° are recorded for cryst. cellulose (ramie fibres). The temp.-dependence of n_o and n_e, and also of the coeffs. of thermal expansion, is intermediate between vals. characteristic of the liquid and solid states, indicating that there are very few cross valency-bonds between the fibre mols.
F. J. G.

Effect of an excitation energy on the specific heat of liquid helium II and its relation to the exchange effect in a non-ideal Bose–Einstein gas. A. MICHELS, A. BIJL, and J. DE BOER (Nature, 1939, **144**, 594—595). L. S. T.

Specific heat of methane under pressure. O. N. TRAPEZNIKOVA and G. A. MILJUTIN (Nature, 1939, **144**, 632).—The sp. heat of CH_4 between 12° and 30° k. at pressures up to 2000 kg. per sq. cm. shows two max. which shift with changing pressure. Curves showing the change in temp. of these max. with a change in pressure are reproduced. The substitution of D for H has an effect similar to increasing the pressure on ordinary CH_4. L. S. T.

Entropy of cyanogen. Heat capacity and vapour pressure of solid and liquid. Heats of fusion and vaporisation. R. A. RUEHRWEIN and W. F. GIAUQUE (J. Amer. Chem. Soc., 1939, **61**, 2940—2944).—The m.p. and b.p. of C_2N_2 are 245.27° and 251.95° k., respectively. The v.p. (internat. cm. Hg) from 202° k. to the m.p. is $\log_{10} P = -1795.9/T - 0.001464T + 9.42442$ and from the m.p. to 253° k. $\log_{10} P = -1525.7/T - 0.0040842T + 8.96542$. C_p has been measured from 14.89° k. to the b.p. The molal heats of fusion and vaporisation are respectively 1938 ± 1 and 5576 ± 5 g.-cal. The entropy of the (ideal) gas at 1 atm. is 55.43 g.-cal./degree/mol. at

251.95° k. and 57.64 at 298.1° k., in good agreement with the val. deduced from spectroscopic data.
W. R. A.

Entropy of hydrogen cyanide. Heat capacity, heat of vaporisation, and vapour pressure. Hydrogen bond polymerisation of the gas in chains of indefinite length. W. F. GIAUQUE and R. A. RUEHRWEIN (J. Amer. Chem. Soc., 1939, **61**, 2626—2633).—The m.p. and b.p. of HCN are 259.86° and 298.80° k., respectively. The v.p. of liquid HCN is $\log_{10} P$ (internat. cm. Hg) $= -1600.8/T - 0.0017835T + 7.77114$ and the triple point pressure is 14.048. Heat capacity data are given from 14° k. to b.p. Near 170° k. there occurs a narrow region of high C_p, whilst between 140° and 170° k. the attainment of thermal equilibrium is less rapid. The entropy change corresponding with the effect at 170° k. is 0.022 g.-cal./degree/mol. The heats of fusion and of vaporisation are 2009 and 6027 g.-cal. per mol., respectively. The entropy of an equilibrium mixture of HCN and its polymerides at 298.80° k. is 47.21 g.-cal./degree/mol. From available v.d. data the existence of polymerides is shown and the relative amounts of various associated forms up to the heptameride have been calc. Polymerisation occurs through straight chain H-bonding (this is also responsible for $\sim 3\%$ polymerisation in H_2O vapour at 100°). For HCN the polymerisation introduces a positive correction of 0.73 to the entropy val. For the monomeride the following vals. of $S_{298.1}$ are given : gas, from calorimetric data, 47.92 ; from spectroscopic data, 48.23 ; liquid, 26.97 g.-cal./degree/mol.
W. R. A.

Entropy and heat capacity of propylene. B. L. CRAWFORD, jun., G. B. KISTIAKOWSKY, W. W. RICE, A. J. WELLS, and E. B. WILSON, jun. (J. Amer. Chem. Soc., 1939, **61**, 2980—2981).—Polemical against Powell and Giauque (A., 1939, I, 556). A revised set of vv for C_3H_6 gives ~ 2120 g.-cal. for the potential barrier hindering rotation of the Me group. The entropy of the ideal gas at b.p. (225.35° k.) is 59.93 e.u. compared with a calc. val. of 59.87. W. R. A.

Measurements of heat capacity and heat of vaporisation of water in the range 0° to 100°. N. S. OSBORNE, H. F. STIMSON, and D. C. GINNINGS (J. Res. Nat. Bur. Stand., 1939, **23**, 197—260 ; cf. A., 1937, I, 353).—Using improved apparatus the sp. heat and latent heat of vaporisation of H_2O have been redetermined at various temp. between 0° and 100°. The heat contents of both phases and the sp. vol. of the saturated vapour are deduced. Tables of these quantities are given. The results are compared with previous data. J. W. S.

Thermal properties of saturated water and steam. N. S. OSBORNE, H. F. STIMSON, and D. C. GINNINGS (J. Res. Nat. Bur. Stand., 1939, **23**, 261—270).—From the authors' results (A., 1931, 31 ; 1932, 560 ; 1937, 353 ; and preceding abstract) the heat content, sp. vol., and entropy of both the liquid and saturated vapour phases have been deduced for various temp. between 0° and the crit. temp. (374.15°), and are presented in tabular form. J. W. S.

Specific heats of tantalum in the normal and in the superconducting state. W. H. KEESOM

and M. DÉSIRANT (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 536—537).—In the absence of a magnetic field, Ta (99·96%) appears to show a discontinuity in the sp. heat C at 4·075° K. (cf. 4·38° K. found by Meissner, A., 1929, 250), at which the difference ΔC $(= C_n - C_s)$ in the superconductive and normal states $= 0.00881$ g.-cal. per degree mol. This val. agrees with that obtained from Rutgers' formula (cf. A., 1937, I, 451), but in a magnetic field ΔC is found to be much lower than calc. vals. With fields of 446·8 and 691·6 gauss, sp. heat discontinuities at 3·705 and 3·49° K., respectively, are higher than vals. obtained from the induction curve, but agreeing with the temp. obtained from the resistance curve of Mendelssohn and Moore (A., 1936, 556). The superconductive state may still persist at fields for which $B \neq 0$. $C_n = 464.5(T/246.5)^3 + 0.00141T$, in which the first term is due to the at. lattice and the second to conduction electrons. The Debye characteristic temp. is 246·5° in approx. agreement with Simon and Ruhemann (A., 1928, 40). W. R. A.

Specific heat anomaly of potassium dihydrogen phosphate at the upper Curie point. W. BANTLE (Helv. Phys. Acta, 1939, **12**, 279—281).—The sp. heat of KH_2PO_4 has been measured from 100° to 120° K. with a vac. radiation-calorimeter. Outside the region 110—115° K. the sp. heat is ~28 g.-cal. per mol. per degree, but rises at the Curie point (113°) to 160 g.-cal. per mol. per degree. The energy absorbed in the disappearance of the internal electric field is 60 g.-cal. per mol., giving a val. 0·5 for the Lorentz factor. L. J. J.

Specific heat of a substance showing spontaneous electric polarisation. J. MENDELSSOHN and K. MENDELSSOHN (Nature, 1939, **144**, 595).—The sp. heat of KH_2PO_4, measured between 40° and 130° K., shows no anomaly at the so-called " lower Curie point," indicating that the apparent disappearance of spontaneous electric polarisation towards lower temp. is due to a freezing-in of the dipoles. A marked anomaly occurs at the Curie point (122° K.). L. S. T.

Latent heats of sublimation and evaporation of certain substances. W. HUME-ROTHERY (Phil. Mag., 1939, [vii], **28**, 465—480).—For normal metallic elements the latent heat of fusion is small, and the ratio λ_s/λ_l of the latent heats of sublimation and evaporation at the triple point is ~1. For many substances λ_s/λ_l approximates to the ratio of small whole nos. and the significance of this is discussed. It is also suggested that simple relations exist between the latent heats of the different modifications of allotropic substances. T. H. G.

Cohesion of simple compounds. III. J. M. STEVELS (Rec. trav. chim., 1939, **58**, 931—940; cf. A., 1939, I, 248).—The introduction of certain corrections improves the agreement between calc. and observed vals. for the b.p. of F compounds. F. J. G.

Density and pressure of vapour at low temperatures. II. Nitrobenzene. V. G. GUREVITSCH and K. K. SIGALOVSKAJA (J. Gen. Chem. Russ., 1939, **9**, 1326—1328).—The density of $PhNO_2$ vapour was

measured between 15° and 53°. Brückner's vals. (A., 1931, 1004) are too high. J. J. B.

Pressure, volume, temperature relations of ethylene in the critical region. II. R. L. McINTOSH, J. R. DACEY, and O. MAASS (Canad. J. Res., 1939, **17**, B, 241—250; cf. A., 1939, I, 515).—Nine pressure isothermals for C_2H_4 at 8·92—10·00° have been determined. Evidence is given for the existence of a two-phase system at temp. above that of disappearance of the meniscus. At 9·50° (the classical crit. temp.) the val. of l is ~4·2 cal. per g. Hysteresis of liquid-phase ρ with temp. at const. vol. is attributed to a residual quantity of vapour remaining suspended in the liquid during cooling. A qual. description of the changes occurring in the transition region of liquid to gas is developed from experimental evidence. F. H.

Vapour pressure measurements by new dynamic and static methods. Comparative study of the applicability of the reaction isochore to measurement of heat of vaporisation. D. RĂDULESCU and M. ALEXA (Bull. Soc. Chim. România, 1938, **20**, 89—113).—V.p. of MeOH, Pr^aOH, HCO_2Et, MeOAc, Pr^aOAc, $EtCO_2Et$, $CHCl_3$, CCl_4, $CHBr_3$, $C_2H_4Cl_2$, $C_2H_4Br_2$, $COMe_2$, and C_6H_6 have been measured at several temp. between 0° and 25° by a static and/or dynamic method (cf. A., 1936, 930). $C_2H_4Br_2$ and certain other liquids give inaccurate results by the static method when Hg is used as the manometric liquid; in such cases a glycerol manometer gives more satisfactory vals. Heats of vaporisation of the liquids are calc. by the van 't Hoff isochore. F. L. U.

Vapour pressures and accommodation coefficients of four non-volatile compounds. Vapour pressure of tri-m-cresyl phosphate over polyvinyl chloride plastics. F. H. VERHOEK and A. L. MARSHALL (J. Amer. Chem. Soc., 1939, **61**, 2737—2742).—The v.p. of $(m-$ (I) and $(p-C_6H_4Me)_3PO_4$, $o-C_6H_4(CO_2Bu)_2$, and dibenzyl sebacate have been measured at ~100° by a static method and by three dynamic methods which are described. The accommodation coeffs. for these liquids are unity. The v.p. of the plasticiser in a polyvinyl chloride–(I) plastic is independent of concn. from 15 to 100% plasticiser. W. R. A.

Thermal properties of halides. XII. Measurement of vapour pressure, and the m.p. and saturation pressures of scandium, thorium, and hafnium halides. W. FISCHER, R. GEWEHR, and H. WINGCHEN. **XIII. Saturation pressures of stannous halides.** W. FISCHER and R. GEWEHR (Z. anorg. Chem., 1939, **242**, 161—187, 188—192; cf. A., 1933, 560).—XII. An apparatus for measuring the v.p. (with an accuracy of 0·1—1 mm.) at high temp. of substances which attack quartz and porcelain is described, and used to measure the v.p. of Sc and Th halides. The following data, with some preliminary measurements for $HfCl_4$ and $HfBr_4$, are recorded: $ScCl_3$, m.p. 960±2°, b.p. 967°; $ScBr_3$, m.p. 960±2°, sublimation temp. 929°; ScI_3, m.p. 945±8°, sublimation temp. 909°; $ThCl_4$, m.p. 770±2°, b.p. 921°; $ThBr_4$, m.p. 679±3°, b.p. 857°; ThI_4, m.p. 566±2°, b.p. 837°. The results confirm

the previously derived rules concerning the thermal behaviour of halides.

XIII. By means of an apparatus previously described (A., 1933, 560) the v.p. of $SnCl_2$, $SnBr_2$, and SnI_2 between ~400° and 700° have been measured. The following data are recorded for the three substances, respectively : b.p. 652°, 639°, 714°; heat of evaporation 20·5, 24·5, 25 kg.-cal. per mol.; Trouton const. 22, 27, 25.   O. J. W.

Anomalous thermal expansion of carbon disulphide at low temperatures. J. MAZUR (Nature, 1939, **144**, 328—329).—Between 20° and —112°, the coeff. of thermal expansion of CS_2 (curve given) decreases rapidly with a fall in temp. to a min. at —80°, and then increases.   L. S. T.

Relativistic thermodynamics. D. VAN DANTZIG (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 601—607).—Mathematical.   W. R. A.

Relativistic gas theory. D. VAN DANTZIG (Proc. K. Akad. Wetensch. Amsterdam, 1939, **42**, 608—625).—Mathematical.   W. R. A.

Hildebrand's method of proving " what substances can obey Raoult's law at all pressures and temperatures." I. R. KRITSCHEVSKI (Acta Physicochim. U.R.S.S., 1939, **10**, 885—886).—Hildebrand's method of proving that only liquids having identical vals. of $(\partial p/\partial T)_v$ can form ideal solutions at all pressures and temp. is shown to be incorrect.   O. J. W.

p–v–T relations and an equation of state for unsaturated vapour of methyl alcohol. L. M. LASCHAKOV (Acta Physicochim. U.R.S.S., 1939, **11**, 107—116).—The compressibility of unsaturated MeOH vapour has been investigated at temp. from 170° to 290°, pressures from 10 to 95 atm., and sp. vol. from 8·0 to 100 c.c. per g. Results can be described by a Beattie–Bridgeman equation of state (cf. A., 1927, 819) with an error of 0·21%.   O. D. S.

Forces associated with heat flow in helium II. J. F. ALLEN and J. REEKIE (Nature, 1939, **144**, 475—476).—The force associated with the flow of heat in He II has two components, one a surface effect in which the liquid is forced against the direction of the heat flow, and the other a vol. effect in which the liquid in the centre of the channel is forced in the direction of the heat flow. An apparatus for observing these two effects simultaneously is described. At high heat inputs the surface component appears to become saturated. The results described also help to confirm the view that the fountain effect (A., 1939, I, 410) is associated with the surface of the channel (cf. ibid., 191).   L. S. T.

Thermal conductivity of liquid helium II. E. GANZ (Helv. Phys. Acta, 1939, **12**, 294—295).—Heat impulses are transmitted through a capillary filled with liquid He II with a high velocity (>100 m. per sec.).   L. J. J.

Thermal conductivity of solid helium. A. K. KIKOIN (Acta Physicochim. U.R.S.S., 1939, **10**, 307—312).—The thermal conductivity of solid He below the λ-point is ~1·2 times that of liquid He I, but the data are not sufficiently accurate for conclusions to be reached as to the influence of temp. on the conductivity of the solid.   C. R. H.

Accommodation coefficient of helium on nickel. (MISS) B. RAINES (Physical Rev., 1939, [ii], **56**, 691—695).—The thermal accommodation coeff. of He on gas-free " A " Ni, measured at 90°, 195°, 273°, and 369° K., was 0·048, 0·060, 0·071, and 0·077, respectively ($\pm 0·004$). In the presence of the gas the coeff. rose rapidly to the equilibrium vals. 0·413, 0·423, 0·360, and 0·343, respectively ($\pm 0·012$). The calc. vals. of the two consts. of the interaction potential between a He and a Ni atom are $(0·75 \pm 0·05) \times 10^8$ cm.$^{-1}$ for the exponential decay const., and 430 ± 60 cal. per mol. for the heat of adsorption of He on Ni. The thermal conductivity of " A " Ni, measured at 90° and 195° K., was $0·74 \pm 0·04$ and $0·71 \pm 0·04$ w. per sq. cm. per degree respectively.   N. M. B.

Dunstan's law. A. H. NISSAN (Nature, 1939, **144**, 383—384; cf. A., 1939, I, 411).—A more fundamental form of Dunstan's equation for η is deduced by combining Trouton's rule with the Clausius–Clapeyron and Andrade equations. Limitations of the law are discussed.   L. S. T.

Limiting volumes of oxygen and hydrogen. G. P. LUTSCHINSKI (J. Gen. Chem. Russ., 1939, **9**, 1310—1312).—From the viscosity of 8 compounds of O its limiting vol. is 0·54 c.c. per g. The limiting vol. of H from the η of H_2O between 82° and 100° is 4·40 c.c. per g.   J. J. B.

Influence of an electric field on the streaming velocity of anisotropic liquid p-azoxyanisole in a capillary. G. M. MICHAILOV and V. N. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 415—432).—The velocity of flow of anisotropic liquid p-azoxyanisole through a capillary placed in an electric field is decreased by longitudinal fields, but in transverse fields is measurably increased if the streaming velocity is small and the frequency of the field is not too high. Electric fields are without effect when the temp. approaches the point of transition into the isotropic form.   W. R. A.

Effect of magnetic and electric fields on the streaming velocity of anisotropic liquid p-azoxyanisole in a capillary tube. G. M. MICHAILOV and V. N. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 775—788).—The effect of a transverse magnetic field on the streaming velocity of p-azoxyanisole (I) reaches a saturation val. for sufficiently strong fields. The coeff. of internal viscosity of (I) when the axes of the mol. are perpendicular to the stream and parallel to the velocity gradient is about four times the coeff. when the mols. are arranged parallel to the stream and perpendicular to the velocity gradient. The simultaneous action of a magnetic and an electric field has been investigated. The change in the streaming time from that in the magnetic field alone is due to the orientation of mols. by the electric field.   A. J. M.

Viscosity of liquids at high hydrostatic pressures. R. B. DOW (Phil. Mag., 1939, [vii], **28**, 403—422).—Abs. and relative methods of measurement, including a new apparatus for the rotating-cylinder method, are discussed. η has been measured for mixtures of CS_2 and CCl_4 since these are non-polar

liquids having mols. with quite different force fields. Although η increases with the pressure p for all mixtures, both at 30° and 75°, the ratio η^{30}/η^{75} shows an initial fall as p increases to ~2000 kg. per sq. cm., followed by a rise up to the highest vals. of p employed 10,000 kg. per sq. cm.). Theoretical aspects of viscosity at high pressures are also discussed.

T. H. G.

Equation of state for gaseous mixtures. I. R. KRITSCHEVSKI and J. S. KAZARNOVSKI (Acta Phys-icochim. U.R.S.S., 1939, **10**, 217—244).—Theoretical. A semi-empirical equation, $p = p_1^0 N_1 + p_2^0 N_2 + a \cdot N_1 N_2(p_1^0 - p_2^0)$, where p = total pressure, p_1^0 and p_2^0 = pressures of the pure components, N_1 and N_2 = mol. fractions of the components, and a is a coeff. depending solely on temp., has been derived and successfully applied to compressibility data for six gaseous mixtures.

C. R. H.

Phase equilibria in hydrocarbon systems. Joule–Thomson coefficient of gaseous mixtures of methane and ethane. R. A. BUDENHOLZER, B. H. SAGE, and W. N. LACEY (Ind. Eng. Chem., 1939, **31**, 1288—1292).—The Joule–Thomson coeffs. for three mixtures of CH_4 and C_2H_6 have been determined at 70—220° F. and at pressures of 40—1500 lb. per sq. in. By combining the results with previous data the iso-baric heat capacities of the mixtures under various conditions, and the isothermal enthalpy–pressure coeff. at 160°, have been deduced.

J. W. S.

Gas–vapour solutions at high pressures. I. R. KRITSCHEVSKI and N. E. CHAZANOVA (Acta Physico-chim. U.R.S.S., 1939, **10**, 199—216).—Theoretical. The application of the Gibbs–Dalton law, the Lewis–Randall rule, and equations of state to gas–vapour solutions at high pressures is discussed. Components must possess parallel isometrics in order to form a regular gas solution. A derived equation enables other isotherms to be calc. from an experimentally determined isotherm. Published data for the system CO_2–I satisfactorily fit in with the equation. The electrostatic theory for solutions of polar vapour in non-polar gas has been developed and an equation has been derived which agrees with data for solutions of H_2O vapour in various gases. As pressure increases, the mol. fraction of vapour in the gas phase decreases to a min. val. and then increases. An equation expressing the conditions obtaining at this min. point has been derived but data confirming it are lacking.

C. R. H.

Density and viscosity of glycerol solutions at low temperatures. E. GREEN and J. P. PARKE (J.S.C.I., 1939, **58**, 319—320).—Aq. solutions of 30—80% concn. have been examined at −5° to −40°. η were > vals. published previously.

F. L. U.

Study of diffusion processes by electrolysis with micro-electrodes. H. A. LAITINEN and I. M. KOLTHOFF (Nature, 1939, **144**, 549—550).—Equations for linear and spherical diffusion have been tested by determining current–time curves for the electrolysis of 0·001M-$K_4Fe(CN)_6$ in 0·1N-KCl at 25°±0·02° with various shapes of Pt micro-electrodes. Theoretical curves were obtained only in the case of linear dif-fusion of $K_4Fe(CN)_6$ when using one particular type of electrode.

L. S. T.

Devitrification temperatures of solutions of a carbohydrate series. B. J. LUYET (J. Physical Chem., 1939, **43**, 881—885).—The time required for devitrification of the glasses formed by supercooling aq. solutions of glucose, sucrose, raffinose, and dextrin has been studied as a function of temp. For standard times of keeping the devitrification temp. decreases only slowly with increasing concn., and for the series investigated is the lower the smaller is the mol. wt. of the sugar. Preliminary results with solutions of gums, agar, gelatin, CH_2O, $(CH_2 \cdot OH)_2$, and glycerol indicate that the various radicals exert different influences on the devitrification temp.

J. W. S.

Pressure–volume–temperature relations in solutions. III. Thermodynamic properties of mixtures of aniline and nitrobenzene. R. E. GIBSON and O. H. LOEFFLER (J. Amer. Chem. Soc., 1939, **61**, 2877—2884).—Measurements have been made of the sp. vol. at 25°, the thermal expansions at 10° intervals from 25° to 85°, and the compressions to various pressures ⇸1000 bars at 25°, 45°, 65°, and 85° of six solutions of NH_2Ph in $PhNO_2$ covering the whole range of concn. From the data $(\partial P/\partial T)_r$, $(\partial E/\partial V)_T$, and the vol. changes on mixing are com-puted, and the variation of these quantities when the temp. is changed at const. vol. has been studied. A correlation exists between the effect of temp. and of mixing on the mol. distribution in the liquids on the one hand and the internal pressures and vol. changes on mixing on the other. The attractive pressures of the solutions (cf. A., 1939, I, 558) are represented by $P_A = a'/V^{2 \cdot 737}$. Several equations for the vol. changes on mixing are considered.

W. R. A.

Properties of concentrated solutions of sodium carbonate. L. D. ROBERTS and G. B. MANGOLD, jun. (Ind. Eng. Chem., 1939, **31**, 1293—1295).—The d, n, sp. conductivity, and p_H vals. of 1—6N. aq. solutions of Na_2CO_3 have been determined at various temp. and are tabulated.

J. W. S.

Apparent ionic volumes in aqueous solutions and electrostriction by ionic fields. Y. KOBA-YASHI (J. Sci. Hirosima Univ., 1939, **9**, 241—267).—The compressibility coeff. of H_2O has been investig-ated up to high pressures. An expression for the electrostriction of H_2O by an ionic field has been derived mathematically and is applied to data on uni- and bi-valent ions. The apparent ionic vol. of various ions at infinite dilution and the "ion space radii" have been evaluated.

W. R. A.

Ions of europium distributed between different configurations in homogeneous solutions. S. FREED, S. I. WEISSMAN, F. E. FORTESS, and H. F. JACOBSON (J. Chem. Physics, 1939, **7**, 824—828).—The structure of the absorption spectrum of Eu··· ions is a function of the environment of these ions in solution. Thus addition of KNO_3 to aq. $EuCl_3$ produces structures characteristic of $Eu(NO_3)_3$ in addition to the spectrum of $EuCl_3$, and the spectra of Eu salts in EtOH differ from those of aq. solutions of the corresponding salts. In a mixed H_2O–EtOH solvent $EuCl_3$ has a spectrum indistinguishable from the exactly superposed spectra of $EuCl_3$ in H_2O and in EtOH, the relative intensities varying with the

relative amounts of the components. The lines of the spectrum of $Eu(NO_3)_3$ in the mixed solvent, however, are shifted from the positions which they occupy in the spectra of $Eu(NO_3)_3$ in the pure solvents, the extent of the shift varying continuously with the $H_2O : EtOH$ ratio. These results are discussed with reference to the behaviour of electrolytes in mixed solvents. W. R. A.

Polarising properties of ions in aqueous solutions. I. I. SASLAVSKI (J. Gen. Chem. Russ., 1939, 9, 1094—1100).—The magnitude of the vol. change Δv associated with dissolution of electrolytes in H_2O depends both on the valency of the ions and on their individual properties. In general Δv varies parallel with Δk, the change in internal pressure. The vals. of Δv vary periodically with rising at. wt. in certain series of elements. R. T.

Viscosity of non-ideal binary liquid systems. M. K. SRINIVASAN (J. Indian Chem. Soc., 1939, 16, 305 —307).—The cube root equation, which accurately expresses the η of ideal binary liquid mixtures as a function of the composition, has been modified for non-ideal systems by taking into account the variations of ρ which occur when the components are mixed. The proposed equation agrees as satisfactorily as others with recorded data on 11 binary liquid mixtures the η–composition curves of which either sag or show max. and min. W. R. A.

Viscosity in the systems : ketones–organic acids. I. V. V. UDOVENKO (J. Gen. Chem. Russ., 1939, 9, 1162—1166).—Composition-η and $-d$ curves are given for the systems $COMe_2-R \cdot CO_2H$ ($R = H$, Me, Pr, CH_2Cl, CCl_3) at 20—45°. Evidence of chemical reaction is given by the curves for the system $COMe_2-AcOH$. R. T.

Effect of complex formation in solutions on chemical kinetics. V. A. GOLDSCHMIDT and N. K. VOROBIEV (Trans. Ivanovo Chem. Tech. Inst., 1939, 5—12).—The η–composition curves of binary mixtures of $NPhMe_2$ with $COMe_2$, COPhMe, $PhNO_2$, MeOH, and $CH_2Ph \cdot OH$, and of C_5H_5N with $PhNO_2$ and MeOH exhibit neither max. nor min. The curves for $NPhMe_2$ + MeOH and C_5H_5N + MeOH are the only ones which are convex upwards. Reactions proceeding by way of solvated mols. may have low vals. of the energy of activation and the B factor in Arrhenius' equation. R. C.

Properties of liquid amalgams. V. D. PONOMAREV and S. M. GUBELBANK (J. Gen. Chem. Russ., 1939, 9, 1365—1368).—The cations of weakly dissociated salts, such as $HgCl_2$, or of sparingly sol. salts, such as HgCl, $PbSO_4$, AgCl, Ag_2S, etc., are readily replaced by Zn when the acid suspension or solution is shaken with Zn–Hg. R. T.

Solubility of nitrogen in molten iron–silicon alloys. J. C. VAUGHAN and J. CHIPMAN (Amer. Inst. Min. Met. Eng. Tech. Publ. No. 1109, 1939, 8 pp.; Met. Tech., 1939, 6, No. 7).—The solubility of N_2 at atm. pressure in liquid Fe–Si alloys containing up to 15·8% Si was determined at 1630±30°. The solubility increases from 0·041% in pure Fe to about 0·046% between 1% and 2% Si, and then decreases to about 0·01% at the highest [Si] employed. The

results indicate the formation of an Fe nitride and an Fe silicide in solution and a Si nitride of limited solubility in the melt. R. B. C.

Simultaneous diffusion of nickel and silicon in solid copper. R. F. MEHL and F. N. RHINES (Amer. Inst. Min. Met. Eng. Tech. Publ. No. 1072, 1939, 12 pp.; Met. Tech., 1939, 6, No. 5).—The rates of diffusion of Ni and Si when diffusing simultaneously into Cu were determined at 1000° and 850° and compared with those of Ni and Si when diffusing separately into Cu. The ternary Ni–Cu–Si system involves the quasi-binary system $Cu–Ni_2Si$; the solid solubility of Ni_2Si in Cu decreases with falling temp. and the ppt. is Ni_2Si. The rapid diffusion of Si in Cu is markedly slowed down by the presence of Ni, whereas the low rate of diffusion of Ni into Cu is little, if at all, affected by the presence of Si. The quasi-binary systems $Al–MgZn_2$ and $Al–Mg_2Si$ exhibit a similar behaviour. The pronounced interaction of Ni and Si during simultaneous diffusion becomes more marked with increasing concn. Equality in the diffusion coeffs. of Ni and Si when these solutes diffuse from a core alloy containing Ni and Si in the proportions of Ni_2Si suggests the diffusion of mols. of Ni_2Si. The data can, however, best be explained by assuming the occurrence of momentary strong bonds between Ni and Si atoms when these are on adjacent lattice positions, with resultant retardation in the rate of movement of the more rapidly diffusing solute Si. R. B. C.

Thermodynamic study of the lead–antimony system. H. SELTZ and B. J. DEWITT (J. Amer. Chem. Soc., 1939, 61, 2594—2597).—The e.m.f. of cells of the type Pb (l)|$PbCl_2$ in KCl–LiCl (l)|Pb–Sb (l) have been measured up to 630°, and vals. for activities and relative heat contents of Pb and Sb in their liquid alloys have been calc. The system shows a simple eutectic with α- and β-solid solutions of Sb in Pb and Pb in Sb respectively as solid phases. The eutectic is at 250° and 12·1% Sb. The eutectic solids contain 3·86% Sb for the α-phase and 4·51% Pb for the β-phase. W. R. A.

Transition-point diagram of the zirconium–titanium system. J. D. FAST (Rec. trav. chim., 1939, 58, 973—983).—The transition points of a no. of Ti–Zr alloys have been determined and expressed in the form of an equilibrium diagram showing a min. at 545° for the at. ratio 1 : 1. The transition point of pure Ti is 885°±10°. The m.p. of alloys with 50 and 70 at.-% Ti suggest a min. in the m.p. diagram at ~1575° for ~60 at.-% Ti. Lattice consts. for the alloys are recorded; they indicate a slight contraction on solid solution formation. F. J. G.

Effect of high pressure on the order–disorder transformation in alloys. T. C. WILSON (Physical Rev., 1939, [ii] 56, 598—611).—With electrical resistance as an index of degree of order, the behaviour of the order–disorder transformation for CuAu, Cu_3Au, and CuZn under hydrostatic pressures up to 10,000 kg. per sq. cm. and over the temp. range 50—426° is reported. For temp. below the crit. point, observations are consistent with predictions from reported thermal expansion data and deductions from the

Bragg–Williams theory. The crit. point of CuAu and of Cu_3Au is raised by pressure. Examination of α-brass (Cu_2Zn) indicates slight ordering of the constituents under high pressure.   N. M. B.

Diffusion of hydrogen through iron at room temperature. J. H. DE BOER and J. D. FAST (Rec. trav. chim., 1939, 58, 984—993).—When thin Fe sheets are in contact with aq. solutions of such a p_H as to evolve H_2, diffusion of H through the Fe occurs. At. H, produced in the gas phase by a glowing W spiral, readily diffuses through Fe at room temp.
                                    F. J. G.

Solubility of gases. I. Inert gases in water. D. D. ELEY (Trans. Faraday Soc., 1939, 35, 1281—1293).—Theoretical. The energy and entropy changes accompanying dissolution of the inert gases in H_2O are calc., and are accounted for by assuming two consecutive processes, viz., (1) formation of a cavity and (2) entry of a gas mol. into the cavity. The entropy associated with (1) is zero at 4°, corresponding with a negative temp. coeff., but increases rapidly with rise of temp., so that at 80° the temp. coeff. has become positive, and H_2O then behaves like org. solvents towards the inert gases. At low temp., where the structure of H_2O is important, the gas mols. take up positions between the quasi-lattice points, whereas at higher temp. where the H_2O tends to become a close-packed liquid they share these points equally with other H_2O mols.   F. L. U.

Solubility of double fluorides of aluminium and alkali metals. I. TANANAEV and S. TALIPOV (J. Gen. Chem. Russ., 1939, 9, 1155—1157).—The solubility of Na_3AlF_6 and K_3AlF_6 increases continuously with rising temp., from 0° to 100°. That of $(NH_4)_3AlF_6$ is max. at 50°.   R. T.

Solubility of potassium chloride in antimony trichloride. D. I. SHURAVLEV (J. Gen. Chem. Russ., 1939, 9, 769—770).—Stratification takes place in systems containing 0—12·5% KCl at temp. >460°.
                                    R. T.

Solubility of KCl and NaCl in Al_2Br_6, and of $BiCl_3$ in $SbCl_3$. E. L. STAROKADOMSKAJA (J. Gen. Chem. Russ., 1939, 9, 840—844).—The solubility -temp. curves for KCl and NaCl in $AlBr_3$ are given, and regions of immiscibility of the liquid phases are delimited. The fusion curve for $BiCl_3$–$SbCl_3$ exhibits a break at 201° and 6 mol.-% $BiCl_3$.   R. T.

Solubility of solids in binary solvent mixtures. I, II. E. I. ACHUMOV (J. Gen. Chem. Russs., 1939, 9, 1207—1219, 1220—1236).—I. Theoretical. The solubility of a substance in binary mixtures of solvents is expressed by $Y = Y_1[(100 - x)/100]^{n_1} + Y_2(x/100)^{n_2}$, where Y, Y_1, and Y_2 are the solubilities in g.-mols. per 100 g.-mols. of mixture and of each constituent separately, x is the mol. concn. of one solvent, and n_1 and n_2 are indices, the vals. of which depend on (i) temp., (ii) the val. of x, and (iii) the extent to which each solvent is bound (by solvation) by the other.

II. The above formula is verified for the systems KCl, NaCl, Na_2SO_4, or sucrose–EtOH–H_2O and KCl, Na_2CO_3, or $NaNO_3$–NH_3–H_2O.   R. T.

Ageing and coprecipitation. XXIX. Ageing of ortho-ferric hydroxide in the absence and presence of bivalent ions in ammoniacal medium. I. M. KOLTHOFF and L. G. OVERHOLSER (J. Physical Chem., 1939, 43, 909—922; cf. A., 1937, I, 457).—When $Fe(OH)_3$ formed at room temp. is aged in presence of aq. NH_3, NH_4Cl, and Zn··, Ni··, or Co·· the amount of bivalent metal removed from the solution increases slowly on keeping at room temp. and rapidly at 98°, particularly at low [NH_4Cl]. The effect is attributed to ferrite formation. Little change is observed in the amount of Mg·· removed from solutions, during ageing at either temp. During ageing in the presence of Ca·· the amount of Ca·· adsorbed decreases slowly at room temp. and rapidly at 98°. Ageing of $Fe(OH)_3$ in the absence of metals is accompanied by a decrease in adsorptive properties towards metal ions or dyes. The ageing is very slow in H_2O, more rapid in M-NH_3, and very rapid in 0·01M-NaOH, and is greater at 98° than at room temp. The ageing is inhibited by the presence of Zn··, Ni··, Co··, and Mg··, the effect being attributed to blocking of the OH groups. The amount of acid dye (Niagara-sky-blue) adsorbed by the $Fe(OH)_3$ increases with decreasing p_H of the solution, whilst the adsorption of a basic dye [methylene-blue (I)] shows a reverse effect. Alkali cations repress the adsorption of the (I) cation.   J. W. S.

Selective absorption of hydrogen sulphide. D. V. BEZUGLI and M. M. RUDAKOV (J. Appl. Chem. Russ., 1939, 12, 697—703).—The absorption of H_2S and of CO_2 by falling films of conc. alkali carbonate and sulphide solutions in concentric glass tubes is investigated. At low gas velocities (0·03 m. per sec.) the H_2S absorption coeff. depends on the p_H and, if both gases are present, the H_2S coeff. decreases and that of CO_2 falls sharply. With high gas velocities (0·5—1 m. per sec.) the H_2S absorption coeff. rises sharply and is not affected by the p_H, but CO_2 is not appreciably removed. Thus, 90—98% of the H_2S, but only 7—9% of the CO_2, were absorbed. Explanations for this selective absorption are given.
                                    D. G.

Degassing of hydrogen-charged palladium. F. D. BENNETT (J. Amer. Chem. Soc., 1939, 61, 2683—2686).—Metallic Pd rod takes up a stable charge of H_2 during electrolysis of dil. acid, and H/Pd = 0·698, in agreement with recorded data. Degassing in a vac. at temp. ≮300° removes most of the adsorbed H_2, whilst at <300° the process is much slower and less complete. Subsequent degassing up to the m.p. of the product of the degassing at 300° gives only a trace of H_2.   W. R. A.

Chemisorption of carbon dioxide by reduced iron. III. Thermodynamic consideration of the chemisorption. K. KAWAKITA (Rev. Phys. Chem. Japan, 1939, 13, 87—95; cf. A., 1936, 791).—From equations derived to express the free energy changes of all the reactions possible between reduced Fe and its chemisorbed CO_2, the vals. of ΔG°_{360} have been calc. CO has been identified as an intermediate product formed from CO_2 chemisorbed on the Fe surface and experimental data justify representing the reactions on the Fe surface in the adsorbed state

thus : $Fe + (CO_2) = Fe_xO_r + (CO)$, $2(CO) = C + (CO_2)$. The existence of Fe_3O_4 as a product of chemisorption has been confirmed chemically. The chemisorption, therefore, consists probably of the four reactions $Fe + CO_2 = FeO + CO$, $3FeO + CO_2 = Fe_3O_4 + CO$, $3Fe + 4CO_2 = Fe_3O_4 + 4CO$, $2CO = C + CO_2$, of which the apparent reaction is $3Fe + 2CO_2 = Fe_3O_4 + 2C$.   W. R. A.

Heterogeneous recombination of atoms and calculation of the heat of adsorption of atoms on metallic surfaces. A. SCHECHTER (Acta Physicochim. U.R.S.S., 1939, **10**, 379—388).—The heterogeneous recombination of atoms is discussed generally, and the dependence of the coeff. of recombination on temp. for different mechanisms of recombination is considered. Experimental data on the temp. influence of the coeff. for N atoms on Ni agree with those given by theory. The heat of adsorption of N atoms on Ni and the min. val. of heat of adsorption of N atoms on Pt and of H atoms on Pt and W are calc., and indicate that for pressures of $\not< \sim 0.05$ mm. Hg the recombination of these atoms is due chiefly to collisions between free and adsorbed atoms.   W. R. A.

Adsorption of cations on platinised charcoal in a hydrogen atmosphere. S. PETROV, R. BURSTEIN, and P. KISSELEVA (Acta Physicochim. U.R.S.S., 1939, **11**, 59—66).—The adsorption of Li^+, Na^+, K^+, Ba^{++}, Cd^{++}, La^{+++}, and Th^{++++} from solutions of their chlorides and of Tl^+ from $TlNO_3$ has been investigated. Cations are adsorbed by platinised charcoal of low activity in the order $K^+ > Ba^{++} > La^{+++}$, and by highly active charcoal in the reverse order $K^+ < Ba^{++} < La^{+++}$. This inversion is explained as an ultraporosity effect. Results agree with Stern's theory of the adsorption of cations.   O. D. S.

Adsorption of barium, sodium, and lithium ions by glauconite and its dependence on the $p_{\rm H}$ of the equilibrium solution and on the ionic concentration. E. A. MATEROVA (J. Gen. Chem. Russ., 1939, **9**, 1274—1278).—The change of $p_{\rm H}$ produced by glauconite in solutions of $BaCl_2 + Ba(OH)_2$, $NaCl + NaOH$, and $LiCl + LiOH$ was measured, and the sorption of $Ba^{\cdot\cdot}$, $Na^{\cdot}$, and $Li^{\cdot}$ calc. The sorption increases with the $p_{\rm H}$ and seems to have an electrostatic character.   J. J. B.

Adsorption of organic acids from single and mixed solvents. N. JERMOLENKO and S. LEVINA (Acta. Physicochim. U.R.S.S., 1939, **10**, 451—464).—The adsorption of $o\text{-}OH\cdot C_6H_4\cdot CO_2H$ (I) and Pr^aCO_2H (II) from their mixture in various solvents (CCl_4–C_6H_6; CCl_4–PhMe, C_6H_6–PhMe, C_6H_6–$CHCl_3$; C_6H_6–EtOH, CCl_4–EtOH, CCl_4–$COMe_2$; H_2O–EtOH, $COMe_2$–EtOH, $CHCl_3$–$COMe_2$, $CHCl_3$–EtOH) on active animal C has been investigated. The presence of one acid in the mixed media does not affect fundamentally the character of the adsorption isotherm of the other, and Masius' rule, that the acid more strongly adsorbed when taken separately is the more strongly adsorbed from an acid mixture, is confirmed. The total adsorption of acids from media the components of which are $\simeq$ in polarity, e.g., $COMe_2$–EtOH, and media the components of which are

chemically similar, e.g., C_6H_6–PhMe, is approx. const. with change in the proportion of the components of the medium. The adsorption of (I) in presence of (II) from mixed media consisting of a polar and a non-polar component, e.g., C_6H_6–EtOH, decreases with decreasing concn. of non-polar component. The adsorption of mixtures of (I) and (II) from pure solvents of the same homologous series falls gradually with decrease in the dielectric const. and with an increase in the mol. polarisation of the medium.   W. R. A.

Absorptive properties of synthetic resins. III. S. S. BHATNAGAR, A. N. KAPUR, and M. S. BHATNAGAR (J. Indian Chem. Soc., 1939, **16**, 261—268; cf. A., 1937, I, 234).—The adsorption by acid-condensed phenolic resins of a homologous series of mono- and di-basic aliphatic acids [HCO_2H, AcOH, Pr^aCO_2H; $H_2C_2O_4$, $CH_2(CO_2H)_2$, $(CH_2\cdot CO_2H)_2$, adipic acid] increases with increasing mol. wt. of the acid, whilst in alkali-catalysed phenolic resins and amino-resins the order of adsorption is reversed. The adsorption of various substituted (Cl-, Cl_2-, Cl_3-, Ph-, CN-, NH_2-, OH-) acetic acids on a $m\text{-}C_6H_4(NH_2)_2$ resin has been investigated. Introduction of acidic groups increases the adsorption of AcOH, whilst basic groups cause a decrease. The effect of the NH_2 group in lowering the adsorption is $\gg$ that of the OH group, owing probably to the greater basicity of the NH_2 group.   W. R. A.

Phenomena of adsorption between liquid phases. Analysis of curves. R. MÉRIGOUX and M. AUBRY (J. Chim. phys., 1939, **36**, 221—233).—Interfacial tension (γ)–time curves have been recorded photographically for H_2O and solutions of oleic acid (I) in liquid paraffin and in CCl_4. The families of curves obtained for different concns. of (I) in both solvents are tangential to the γ-axis at the origin. Equilibrium is reached in a few (<10) hr. with the CCl_4 solutions, but is not reached in 24 hr. with paraffin solutions. Formulæ giving the relation between [(I)] and the equilibrium val. of γ (CCl_4), or the val. of γ after a given time (paraffin), are developed. When a solution of (I) is brought into contact with H_2O already covered with a unimol. layer of (I), γ at first increases, reaches a max., and then more slowly decreases; this effect is attributed to desorption of the original unimol. film, and the subsequent adsorption of a multimol. film.   F. L. U.

Capillary properties of α-amino-acids. J. W. BELTON (Trans. Faraday Soc., 1939, **35**, 1293—1298). —Surface tensions (γ) of solutions of glycine (I), alanine (II), $NH_2\cdot CHEt\cdot CO_2H$ (III), and valine (IV) have been measured in the absence and presence of varying amounts of NaCl. $\partial\gamma/\partial[\text{acid}]$ is positive for (I) and (II), and negative for (III) and (IV). When NaCl is present the val. of $\partial\gamma/\partial[\text{salt}]$ for const. acid concn. falls with increasing length of the C chain. $\partial\gamma/\partial[\text{acid}]$ at const salt concn. is const. and independent of salt concn. for (I); for (II) it is smaller, and falls with increasing salt concn., becoming 0 at 4M.; and for (III) and (IV) it is negative and falls more rapidly with increasing salt concn. The surface structure of the solutions is deduced by the Gibbs equation.   F. L. U.

Effect of salts on surface tensions of gelatin solutions. J. W. BELTON (Trans. Faraday Soc., 1939, **35**, 1312—1316).—Measurements of γ by the bubble pressure method are recorded for gelatin solutions alone and in presence of varying concns. of NaCl, KCl, LiCl, KI, and BaCl$_2$. The results are interpreted in terms of surface structure.   F. L. U.

" Breaks " in interfacial tension curves. C. C. ADDISON (Nature, 1939, **144**, 249—250; cf. A., 1938, I, 355).—" Breaks " in the interfacial tension curves, usually associated with complex systems, occur in the simple system C_6H_6–$CH_2Ph\cdot OH$–H_2O. The two breaks may represent the beginning and end of inter-penetration of two identical absorbed films. No break occurs in the curve for CH_2PhCl, which is sol. only in the C_6H_6 phase.   L. S. T.

Wetting and spreading properties of aqueous solutions. Mixtures of sodium carbonate with n-hexoic, n-octoic, n-decoic, lauric, myristic, and palmitic acids. H. L. CUPPLES (Ind. Eng. Chem., 1939, **31**, 1307—1308; cf. A., 1937, I, 512).—The surface tension (γ), interfacial tension against mineral oil (σ), and spreading coeff. (s) of 1% solutions of the fatty acids have been determined in the presence of 0·5—3 mols. of Na$_2$CO$_3$ per mol. of acid. Curves of these properties against the mol. ratio Na$_2$CO$_3$/acid are generally similar in form and their relative positions follow approx. the order of increasing mol. wt. of the acid. For the lower acids the abrupt rise in γ occurs at mol. ratio 0·5, whereas for the higher acids it is at ~1·0. This is attributed to the behaviour of Na$_2$CO$_3$ as a diacid base with the lower acids, but as a monacid base with the higher acids. For solutions of oleic acid γ, σ, and s vary only slightly with the [Na$_2$CO$_3$]. The high s of such solutions explains the good detergent and wetting action of oleates.   J. W. S.

Linear phenomena. V. Linear phenomena on a two-dimensional paraffin colloid. T. A. KRASNOVA, P. F. POCHIL, and D. L. TALMUD (Acta Physicochim. U.R.S.S., 1939, **10**, 347—352).—To fulfil conditions for the measurement of linear adsorption (A., 1938, I, 571) paraffin was used as a two-dimensional colloid, and Me$_2$ tetradecanedicarboxylate as adsorbate. Colloidal solutions prepared by dissolving paraffin in C_6H_{14} were placed on H_2O in an Adam trough. Ultramicroscopic investigations proved their high degree of dispersity, and the linear adsorption of the ester on the paraffin colloid was measured by comparing individual force–area curves for paraffin and ester on pure H_2O with those for ester on paraffin solution. The no. of linearly adsorbed mols. was calc., and saturation of the linear boundary was shown.   W. R. A.

Comparison of the adsorption, electrolytic, and interference methods of measuring film areas. F. H. CONSTABLE (Nature, 1939, **144**, 630).—Data for palmitic acid on metallic granules with activated surfaces and when covered with coloured oxide films, obtained by the three methods, are recorded.   L. S. T.

Lateral cohesion in protein monolayers. L. FOURT (J. Physical Chem., 1939, **43**, 887—899).—

The surface viscosity (η) of unimol. layers of cholesterol, casein, and nerve protein has been determined from the damping of a vane oscillating in the film, and an index of the surface elasticity deduced from the shortening of the period of oscillation. For the protein the η and elasticity of the film vary considerably with the p_H of the solution on which the film is spread, the film becoming elastic rapidly on solutions of p_H 5·0 and 4·3, but only slowly on solutions of p_H 2·0. This is interpreted as indicating that the linkages formed within the film are ionic. Quant. spreading into a unimol. film occurs only when the factors bringing about distribution of the protein precede or overbalance the effects of elastic film formation.   J. W. S.

Technique for the spreading of proteins and the " spreading number." D. DERVICHIAN (Nature, 1939, **144**, 629—630).—Proteins from aq. solution can be spread on H_2O by adding to the H_2O small amounts of an active substance, such as $C_5H_{11}\cdot OH$, BuOAc, or EtCO$_2$Bu, which lowers γ. Various types of proteins, particularly myosin, amandin, and edestin, have thus been spread on H_2O, dil. HCl, or dil. NaOH. A substance may have a very low spreading pressure and yet be spread by this method to give a film stable under relatively high pressures. The term " spreading no." is discussed.   L. S. T.

Thickness of built-up films. G. I. JENKINS and A. NORRIS (Nature, 1939, **144**, 441).—The thickness of built-up films of ~20 A. on metal is found from spectrophotometric determinations of the λ of light which gives an intensity min. for a given film thickness. Test data for Ba stearate deposited on stainless steel give thickness vals. in agreement with those obtained by other methods.   L. S. T.

Evaporation of built-up molecular films. S. J. GREGG and E. E. WIDDOWSON (Nature, 1939, **144**, 666—667).—The determination of the condensation coeff., α, of films of stearic (I) and arachidic (II) acids on stainless steel, and of the free acid content of built-up soap films [Ba stearate (III)] on stainless steel, by evaporation of the films in a high vac. are described. For (I) and (II), α is 0·01$\pm$0·004. The curve for (III) is reproduced.   L. S. T.

Rules governing the removal [from aqueous surfaces] of multimolecular films of stearic acid (Langmuir films). (MLLE.) L. DENARD (J. Chim. phys., 1939, **36**, 210—217).—The nature of films of stearic acid (I) deposited on a plate of polished Cr during the immersion and retraction of the latter through 0·01N-HCl covered with a unimol. layer of (I) depends on the surface pressure (F) prevailing during the operation. For $F >1<10$ dynes per cm. the layer removed by the Cr on immersion slips off and is re-spread on the H_2O on retraction; for $F >10 <25$ the amount that slips off ($F <20$) or becomes attached ($F >20$) during retraction is $>$ that removed on immersion; and for $F >25$ complete layers are removed both on immersion and on retraction. Measurement of the area per mol. occupied by (I) in the deposited films, which correspond with Langmuir's Y- and X-films, shows that they are the counterpart, in two dimensions, of the polymorphic varieties of (I).   F. L. U.

Interaction of two colloidal particles, using the complete Debye–Hückel equation. S. LEVINE (J. Chem. Physics, 1939, **7**, 831—848).—Mathematical. Using the original Debye–Hückel equation an approx. method of calculating the mutual electrical energy of two colloidal particles has been developed. The method is applicable to binary electrolytes (symmetrical type) only. W. R. A.

Diffusion in colloidal media. J. M. REINER (Bull. Math. Biophys., 1939, **1**, 143—149).—The retardation of the diffusion of a solute through a medium containing large colloidal particles, consequent on the adsorption of solute on them, is discussed, and its biological implications are considered. F. L. U.

Depolarisation of light scattered by colloidal solutions. A. BOUTARIC and (MLLE.) J. BRETON (J. Chim. phys., 1939, **36**, 193—200).—In colloidal solutions of mastic, As_2S_3, $Fe(OH)_3$, clay, and bentonite traversed by a beam of natural or vertically polarised light the corresponding coeffs. of depolarisation (ρ_n, ρ_v) of the light scattered at right angles increase with concn. For a given concn. ρ_n and ρ_v increase with the particle size, whether this is determined by the mode of prep., or changes spontaneously with time. Variations in ρ for horizontally polarised light are less definite. F. L. U.

Creaming of rubber latex.—See B., 1939, 1151.

Action of copper salts on emulsions stabilised by sodium oleate. A. R. MARTIN and R. N. HERMANN (Nature, 1939, **144**, 479).—Addition of a Cu salt equiv. to the Na oleate (I) present in emulsions of C_6H_6 in H_2O stabilised by (I) separates C_6H_6 and a solute which colours the C_6H_6 green or blue. Evaporation of the C_6H_6 gives a dark green, waxy solid containing Cu : oleate in the ratio 1 : 3·4, and some Na. Cu oleate prepared from aq. $CuSO_4$ and aq. (I) is at first insol. in C_6H_6 and contains Cu : oleate in the ratio 1 : 2·05. The nature of the double layer around the oil droplets of the emulsion is discussed. L. S. T.

Electrochemistry of platinum sols. IV. Particle charge of hydrogen platinum sols. A. ZIMIN and N. BACH (Acta Physicochim. U.R.S.S., 1939, **11**, 1—20; cf. A., 1938, I, 194).—The conductance titration curves of H_2–Pt sols with NaOH and $Ba(OH)_2$ and the variation in cataphoretic velocity at different stages of titration have been investigated. The radius of the particles calc. from vals. of ζ by the method of Müller agrees with that calc. using vals. of the zero point charge obtained from adsorption data for Pt electrodes. O. D. S.

Coagulation of colloids by electrolytes. XIII. Electrochemical properties and coagulation of unidisperse silver sols. M. E. SCHISCHNIASCHVILI and A. J. RABINOVITSCH. **XIV. Electrostatic theory of coagulation and the limits of its applicability to silver sols.** A. J. RABINOVITSCH and M. E. SCHISCHNIASCHVILI (Acta Physicochim. U.R.S.S., 1939, **11**, 185—205, 206—224).—XIII. Unidisperse Ag sols made by the nuclear method and purified by dialysis contain no Ag˙ in the outer member of the double layer. The small amount of titratable Ag found in the sols is considered to be derived from a stabilising anionic complex. H˙ is displaced from the particles by addition of KNO_3, $Ba(NO_3)_2$, and $La(NO_3)_3$ to the extent, respectively, of 0·15, 2·2, and ~40% of the added electrolyte. Data are recorded for the mobility of the particles during dialysis, and after the addition of varying amounts of K˙, Ba˙˙, and La˙˙˙. Parallelism is observed between the displacement of H˙ by K˙, Ba˙˙, and La˙˙˙ and the effect of these ions on the ζ-potential.

XIV. Müller's theory of coagulation (Kolloid-Beih., 1928, **26**, 274) accords with the measurements of the ζ-potential of unidisperse Ag sols when KNO_3 is used as coagulating electrolyte, but not when $Ba(NO_3)_2$ or $La(NO_3)_3$ is used. It is inferred that Müller's theory is applicable only when exchange adsorption is negligibly small; with coagulating ions of valency >1 this is generally not true. F. L. U.

Chemistry of colloid–colloid reactions. VIII. Mechanism of protection by higher carbohydrates. W. PAULI, J. SZPER, and S. SZPER (Trans. Faraday Soc., 1939, **35**, 1316—1327).—The behaviour of Au sols towards dextrin, sol. starch, and gum arabic is completely analogous to that of Sb_2S_3 sols (A., 1939, I, 563). Congo-blue sols are not protected, but are apparently sensitised, by dextrin. Gum arabic when in the acidoid condition does not protect Congo-blue, but does so when neutralised with MgO. The behaviour of the three sols studied towards carbohydrate protectives is reviewed and interpreted in terms of interaction with ionogenic groups on the surface of the colloid particles. F. L. U.

Time of set of silica gels. III. Changing effects of alcohols over a p_H range. L. A. MUNRO and J. A. PEARCE (Canad. J. Res., 1939, **17**, B, 266—280, cf. A., 1939, I, 77).—The total effect and the individual variation of mono- and poly-hydric alcohols on the setting time of SiO_2 gels increases with increasing alkalinity of the gel. That ϵ of the alcohol is not a decisive factor in coagulation is shown by the const. effect obtained for an equal no. of alcohol mols. at p_H 7. In acidic systems all the alcohols studied retard the time of setting of the gel but in alkaline systems only the higher polyhydric alcohols behave in this way. The monohydric alcohols and $(CH_2 \cdot OH)_2$ change from accelerators to retarders at p_H 7·4 to 8·5 but the p_H at reversal for each alcohol does not coincide with the p_H at which the original gel shows min. setting time. F. H.

Swelling of xerogels and powdered disperse substances during sorption of water vapour. M. V. TSCHAPEK and P. V. SHURAVEL (Acta Physicochim. U.R.S.S., 1939, **10**, 867—880).—A technique for studying the swelling of xerogels and powdered disperse substances during the sorption of H_2O vapour is described. Elastic gels and disperse substances with individual grains (e.g., clay, soil) swell during sorption and contract during desorption, whereas hard gels (e.g., charcoal, SiO_2 gel) undergo no change in vol. during either process. Swelling commences when the relative aq. v.p. is 0·5 and reaches a max. when it is 1. Rise of temp. increases the rate of

swelling but does not affect its magnitude. The mechanism of the swelling process is discussed.
O. J. W.

Elastic reactions of gels. F. MICHAUD (J. Chim. phys., 1939, **36**, 201—209).—The reactions of rigid gels towards changes in their environment, whether mechanical or osmotic, are considered theoretically, and discussed with reference to the behaviour of living cells (cf. A., 1939, I, 469).   F. L. U.

Binuclear ethylenediaminecobaltic complexes. H. BRINTZINGER and H. PLESSING (Z. anorg. Chem., 1939, **242**, 193—196; cf. A., 1937, I, 184).—Mol. wt. measurements by a dialysis method indicate the existence of the ions $[Co_2\{en_4(NH_3)_4\}]^{6+}$, $[Co_2\{en_4(NH_3)_2Cl_2\}]^{4+}$, and $[Co_2\{en_2(NH_3)_4Cl_4\}]^{2+}$, in which the two Co atoms are linked together in a bridge structure by two en mols.   O. J. W.

Formato-complexes. H. BRINTZINGER, H. PLESSING, and W. RUDOLPH (Z. anorg. Chem., 1939, **242**, 197—200).—Mol. wt. determinations by means of a dialysis method show that the complex formato-anions of Co^{II}, Ni^{II}, Zn^{II}, Cd^{II}, Cr^{III}, and Fe^{III} have the same composition in solution as in the cryst. state (cf. Lossen and Voss, A., 1892, 140). Cu^{II}, however, forms the tetraformato-complex anion, $[Cu(HCO_2)_4]''$, in solution.   O. J. W.

Existence of chemical interactions between the hæms in ferrihæmoglobin (methæmoglobin) and the rôle of interactions in the interpretation of ferro-ferrihæmoglobin electrode potential measurements. C. D. CORYELL (J. Physical Chem., 1939, **43**, 841—852).—Equilibrium data for reactions between ferrihæmoglobin (I) and SH' and N_3' ions indicate that stabilising interactions between hæms occur in these systems as in the ferrohæmoglobin (II) $-O_2$ system. The sigmoid coeff. n of Hill's equation for hæmoglobin saturation equilibria is correlated with the effective interaction const. α in Pauling's theory of interactions between adjacent hæms. The total effective interaction energies for the equilibria between (I) and SH', N_3', F', and OH' ions are 3360, 3120, 0, and 0 g.-cal. per g.-mol., respectively. In the first two cases complexes with covalent Fe atoms are formed, whilst in the other cases complexes with predominantly ionic Fe atoms are formed. Potentiometric measurements on the (I)–(II) electrode indicate that the val. of n in the Nernst equation is identical with that of the sigmoid coeff. The val., ~1·6, confirms that interactions occur between ionically bound Fe compounds, with an interaction energy of ~2600 g.-cal. per g.-mol.   J. W. S.

Effect of temperature on composition of complexes formed by interaction of chlorides in solution. A. V. TITOV (Trans. Ivanovo Chem. Tech. Inst., 1939, 12—14).—The vol. changes when aq. solutions of NaCl and $ZnCl_2$ are mixed indicate that a complex Na_2ZnCl_4 is formed and, below 0°, $NaZnCl_3$.
R. C.

Solubility of mercuric halides in solutions of potassium halides. Character of the mercuric halide complex ions. Evidence for polymerisation of mercuric chloride. A. B. GARRETT (J. Amer. Chem. Soc., 1939, **61**, 2744—2748).—The

solubilities of $HgBr_2$ and HgI_2 in KBr and KI solutions and the solubility of $HgBr_2$ in H_2O have been determined. Calculations of the equilibrium consts. for the formation of complex ions of Hg halides indicate the formation of $HgBr_3'$, HgI_3', and HgI_4'' [earlier work indicated the formation of $HgCl_3'$ with small amounts of $(HgCl_2)_x$ and $(HgCl_2)_xCl'$]. The anomalous solubility of $HgCl_2$ in dil. Cl' solutions is attributed to the polymerisation of $HgCl_2$ and this is supported by other evidence. The $HgCl_3'$ ion is formed chiefly in Cl' solutions. The free energies of formation $(\Delta \bar{G}_{298}^{\circ})$ of the various ions from Hg halide and halide ions are : $HgCl_3'$, −1700; $HgBr_3'$, −365; HgI_3', 430; HgI_4'', −2100 g.-cal. per mol.
W. R. A.

Thermodynamic dissociation constants of α-alkylsulphonylpropionic acids. A. MELLANDER (Arkiv Kemi, Min., Geol., 1939, **13**, A, No. 4, 9 pp.).—The following K_0 vals. are derived from conductivity data : α-methyl- 2·930, -ethyl- 2·734, -n-propyl- 2·626, -isopropyl-sulphonylpropionic acid 2·515 × 10^{-3}. Λ_0 vals. for the K, Na, Na, and K salts, respectively, are 107·42, 81·68, 80·12, and 103·22.
A. J. E. W.

Expression of p_H as an arithmetic quantity. L. B. MILLER (Paper Trade J., 1939, **109**, 21 Sept., 22—23; cf. A., 1939, I, 262).—The use of the symbols A_H and A_{OH}, representing " active acidity " and " active alkalinity " respectively in an arithmetic method of expressing [H˙] has advantages over the p_H (logarithmic) method.   H. A. H.

Solution theory applied to zinc sulphate solutions. I. Activity coefficients in isodielectric media. Y. KOBAYASHI (J. Sci. Hirosima Univ., 1939, **9**, 269—298).—The activity coeff. of $ZnSO_4$ in 15·65% aq. glycerol (I) and in 10% aq. MeOH has been determined by measuring the e.m.f. of the cells Zn–Hg|$ZnSO_4$ (M.), (I) (15·65%)–H_2O, $PbSO_4$ (solid)| Pb–Hg, and Zn–Hg|$ZnSO_4$ (M.), MeOH (10%)–H_2O, $PbSO_4$ (solid)|Pb–Hg at 25° and various [$ZnSO_4$]. The activity coeff. and solvation energy are calc. from the Debye–Hückel theory. The solubility of $PbSO_4$ in aq. (I) in presence of $ZnSO_4$ is discussed.
W. R. A.

Equilibria between liquid and vapour in the system ethyl alcohol–cellosolve–water. E. M. BAKER, R. E. CHADDOCK, R. A. LINDSAY, and R. C. WERNER (Ind. Eng. Chem., 1939, **31**, 1263—1266; cf. following abstract).—The n and d of various mixtures of EtOH, H_2O, and OH·[CH_2]$_2$·OEt have been determined and utilised to study the compositions of the distillates formed by boiling liquids of various compositions.   J. W. S.

Equilibria in the systems ethyl alcohol–water, ethyl alcohol–cellosolve, and cellosolve–water. E. M. BAKER, R. O. H. HUBBARD, J. H. HUGUET, and S. S. MICHALOWSKI (Ind. Eng. Chem., 1939, **31**, 1260—1262).—A distillation apparatus which enables equilibrium to be reached between a boiling liquid mixture and its vapour, and allows the subsequent removal of samples of the liquid and distillate, is described. The b.p. and composition of the saturated vapours are recorded for various EtOH–H_2O, EtOH–OH·[CH_2]$_2$·OEt (I), and (I)–H_2O mixtures.

(I) and H_2O form a const.-b.p. mixture containing 92·1 mol.-% of H_2O. J. W. S.

Binary liquid systems. I. Vapour–liquid equilibria in the system carbon tetrachloride–ethyl acetate. P. W. SCHUTZ (J. Amer. Chem. Soc., 1939, **61**, 2691—2693).—The binary system CCl_4–EtOAc has a min. b.p. of 71·65°/685 mm. for 58·2 mol.-% CCl_4. From data at other pressures it appears that, in distinction to other similar systems, the rate of change of composition of the CCl_4–EtOAc azeotrope decreases as the pressure decreases. W. R. A.

Binary systems containing hydrazine. III. Thermal analysis of the system hydrazine–phenol. V. I. SEMISCHIN (J. Gen. Chem. Russ., 1939, **9**, 788—791).—The fusion curve suggests formation of a 1 : 2 *compound*, m.p. 63·6° (decomp.). 1 : 1 and 1 : 4 compounds previously reported are not confirmed. R. T.

Phase equilibrium relations in the system Na_2SiO_3–Li_2SiO_3–SiO_2. F. C. KRACEK (J. Amer. Chem. Soc., 1939, **61**, 2863—2877).—The phase equilibrium of the system Na_2SiO_3–Li_2SiO_3–SiO_2 has been investigated by the methods of quenching and thermal analysis. The only ternary compound is $NaLiSiO_3$, melting incongruently at 847°. At the liquidus the primary phases are $(Na_2,NaLi)SiO_3$ solid solutions, Li_2SiO_3, $Na_2Si_2O_5$, $Li_2Si_2O_5$, and the three cryst. modifications of SiO_2. The liquidus fields meet at two ternary eutectics (*a*) at 697°, with $(Na_2,NaLi)SiO_3$, Li_2SiO_3, and $Na_2Si_2O_5$, and (*b*) at 637°, with $Li_2Si_2O_5$, $Na_2Si_2O_5$, and quartz as constituents. $Li_2Si_2O_5$ melts incongruently throughout its region of existence, the reaction temp. decreasing from 1033°, in the system Li_2SiO_3–SiO_2, to 641°, the peritectic end-point in the ternary system with $Li_2Si_2O_5$, Li_2SiO_3, and $Na_2Si_2O_5$ coexisting. The temp. for the inversion quartz $\rightleftharpoons$ tridymite is 867°±3°. Revised data are given for the systems Na_2SiO_3–SiO_2 and Li_2SiO_3–SiO_2, showing that $Na_2Si_2O_5$ is trimorphous and that $Li_2Si_2O_5$ is polymorphic. Vals. of n for a no. of the glasses are given and the co-crystallisation of Na and Li compounds in solid solutions is discussed. W. R. A.

Equilibrium in the system NO–NO_2–HNO_3–H_2O at 0°. D. A. EPSCHTEIN (J. Gen. Chem. Russ., 1939, **9**, 792—793).—Equilibrium coeffs. for NO–NO_2 mixtures over 35—62% HNO_3 at 0° are recorded. R. T.

Solubility in the system $(NH_4)_2SO_4 + 2HCl = H_2SO_4 + 2NH_4Cl$ at 25°. J. B. BLÜMBERG and A. B. ZDANOVSKI (J. Gen. Chem. Russ., 1939, **9**, 814—818).—The phase diagram (partial HCl pressure 1 atm.) of the quaternary system is given. The solid phases are : NH_4Cl, NH_4HSO_4, $(NH_4)_3H(SO_4)_2$, and $(NH_4)_2SO_4$. R. T.

Equilibria in the system NH_4F–BeF_2–H_2O at 0°. A. V. NOVOSELOVA and M. J. AVERKOVA (J. Gen. Chem. Russ., 1939, **9**, 1063—1066).—The phase diagram suggests the existence of the *salts* $2NH_4F,BeF_2$ and NH_4F,BeF_2. R. T.

System Li_2SO_4–$Al_2(SO_4)_3$–H_2O at 0°. H. A. HORAN and J. A. SKARULIS (J. Amer. Chem. Soc.,

1939, **61**, 2689—2691).—Details are given for the prep. of hydrated $Al_2(SO_4)_3$ of definite composition, corresponding with $Al_2(SO_4)_3,17H_2O$. The aq. solubilities of $Al_2(SO_4)_3$ and Li_2SO_4 at 0° are 27·50% and 26·50% respectively. In the ternary system only two solid phases exist, viz., Li_2SO_4,H_2O and $Al_2(SO_4)_3,nH_2O$ ($n \simeq 15$—18). The invariant point for the system is 16·83% $Al_2(SO_4)_3$, 14·45% Li_2SO_4. W. R. A.

Equilibria in systems involving salting-out. R. V. MERTZLIN (J. Gen. Chem. Russ., 1939, **9**, 1303—1309).—A discussion of salting-out from the point of view of the theory of heterogeneous equilibria. Salting-out may not be confined to ions only. J. J. B.

Hydrothermal reactions. II. Magnesium hydrosilicates. II. W. JANDER and R. FETT (Z. anorg. Chem., 1939, **242**, 145—160; cf. A., 1938, I, 262).—The system MgO–SiO_2–H_2O has been studied at 300—600° and at high pressures. The thermal diagram shows that in this region the only compounds that occur are serpentine (I) and talc. Anthophyllite and meerschaum are not formed. At low pressures Mg_2SiO_4 is formed. The following equilibrium between Mg_2SiO_4 and (I) occurs : $2\{3MgO,2SiO_2,2H_2O\} \rightleftharpoons 3Mg_2SiO_4 + SiO_2 + 4H_2O$. The heat of the reaction is calc. to be 18 kg.-cal. per mol. H_2O. The formation of humites by the addition of HF or MgF_2 to the system has also been studied. X-Ray measurements suggest that these substances contain the basic salt $Mg(OH)F$. O. J. W.

Equilibrium phases in the system CaO,Cr_2O_3–CaO,Al_2O_3. F. I. VASENIN (J. Appl. Chem. Russ., 1939, **12**, 651—654).—The system forms many solid solutions. The m.p. diagram shows neither max. nor min. Solutions of CaO,Al_2O_3 in CaO,Cr_2O_3 are easily prepared if air is admitted, but solutions of CaO,Cr_2O_3 in CaO,Al_2O_3 are obtained with difficulty since chromites are oxidised to chromates in presence of large amounts of CaO and Al_2O_3. The colour of the solid solutions gradually changes from white to dark green; it is stable to moist CO_2. D. G.

Approximate thermodynamic calculations. P. DROSSBACH (Metall u. Erz, 1936, **33**, 515—518; Chem. Zentr., 1937, i, 3119; cf. A., 1938, I, 458).—Tables are given for calculating the heat of reaction, heat content, and change of thermodynamic potential for equilibria in which the mol. heats are given by $C_p = C'_p + \alpha T - \beta/T^2$. An approx. graphical method for the determination of α and β is described. A. J. E. W.

Hydrazine. Heat of formation of hydrazine and hydrazine hydrate. A. M. HUGHES, R. J. CORRUCCINI, and E. C. GILBERT (J. Amer. Chem. Soc., 1939, **61**, 2639—2642).—Details of an adiabatic calorimeter are given. Heats of combustion of N_2H_4,H_2O and N_2H_4 are respectively 146,936 and 148,635 ± 30 g.-cal. per mol. These data are used to calculate the following vals. : heats of formation, N_2H_4 (*g*) 22,250; (*l*) 12,000; N_2H_4,H_2O (*l*) 10,300; dil. solution 8160; heat of hydration of N_2H_4, —1700 g.-cal. per mol. W. R. A.

Determination of the standard free energies of formation of metallic sulphides by the method

of electromotive forces of galvanic cells. A. F. KAPUSTINSKI and J. A. MAKOLKIN (Acta Physicochim. U.R.S.S., 1939, **10**, 245—258).—Using Pt–H_2 and sulphide electrodes, the free energies and heats of formation of sulphides have been determined, and as a result of comparison with other data the following vals. are respectively proposed : Ag_2S —9500, —7550 ; α-Cu_2S —19,220, —18,500 ; PbS —20,990, —22,490 ; SnS —19,680, —18,180 g.-cal. The calc. solubility product for SnS is 1.15×10^{-27}. C. R. H.

Heat of combusion of *cis-* and *trans*-azobenzene. R. J. CORRUCCINI and E. C. GILBERT (J. Amer. Chem. Soc., 1939, **61**, 2925—2927).—The isothermal heats of combustion of *cis-* and *trans*-NPh:NPh are 1555.6 ± 0.2 and 1545.7 ± 0.3 kg.-cal. per mol. respectively ; the calc. vals. of the heats of formation are —75.65 and —85.55 kg.-cal. per mol. respectively ; the calc. heat of transition *cis* → *trans* is 9.9 kg.-cal. per mol. W. R. A.

Partial vapour pressure of aqueous ethylamine solutions. B. P. DAILEY and W. A. FELSING (J. Amer. Chem. Soc., 1939, **61**, 2808—2809).—From measurements of the partial v.p. of aq. NH_2Et, $NHEt_2$, and NEt_3 (0.05—2.2M.) at 25°, the free energy decreases attending the change amine (liquid) → amine (1M.) have been evaluated as 2905, 1583, and —103 g.-cal. per mol. respectively. W. R. A.

Heat of dissolution of sucrose.—See B., 1939, 1166.

Electrode potentials of metals subjected to mechanical deformation. I. L. V. NIKITIN (J. Gen. Chem. Russ., 1939, **9**, 794—803).—The potential of Cu electrodes falls, and of Ag electrodes rises, during deformation. The effects are ascribed to rise in temp. R. T.

Platinum electrode. VII. VIII. Effect of poisoning on the capacity of the platinum electrode. A. SCHLIGIN and B. ERSCHLER (Acta Physicochim. U.R.S.S., 1939, **11**, 45—58; cf. A., 1937, 1, 200).—The poisoning of smooth and platinised Pt electrodes by As_2O_3, KCN, and $HgCl_2$ has been studied. The activity of the poisons increases in the order As_2O_3 < KCN < $HgCl_2$. The agreement between the results for smooth and platinised electrodes indicates that their surface structures are similar. O. D. S.

Difference effect in passivity phenomena. V. ČUPR (Korros. u. Metallschutz, 1939, **15**, 256—261). —The behaviour of systems consisting of a compound electrode (Zn in $ZnSO_4$ and Cu in $CuSO_4$) with a reference electrode has been studied, and results in agreement with theory have been obtained. These considerations are then applied to the so-called "difference effect," the views of Müller (A., 1936, 1474) being supported. F. J. G.

Silver and mercurous iodide electrodes. W. C. VOSBURGH, P. F. DERR, G. R. COOPER, and R. G. BATES (J. Amer. Chem. Soc., 1939, **61**, 2592—2594). —The cell Ag|AgI, I′|I′, Hg_2I_2|Hg has an e.m.f. of 0.1112 v. at 25° (temp. coeff. = 0.00030 v. per degree), which is not as const. or reproducible as was expected. Calculation from this val. gives ~0.1517 v.

at 25° for the normal potential of the AgI electrode. Although each of the electrode systems in the above cell is highly reproducible under favourable conditions, no single electrolyte has been found which does not affect unfavourably one or other of the electrodes. W. R. A.

Relation between glass electrode theories of Nikolsky and Dole. M. DOLE (Acta Physicochim. U.R.S.S., 1939, **10**, 707—710).—The assumptions made by Nikolsky in the derivation of his theory of the glass electrode (A., 1938, I, 143) are identical with those made by Dole (A., 1935, 170), and the resulting mathematical expressions are shown to be equiv. A. J. M.

Rôle of electrons in the functioning of cells. Daniell cell. V. KARPEN (Compt. rend., 1939, **209**, 509—511).—An expression for the e.m.f. of a Daniell cell is derived, using previous results (A., 1939, I, 567), and generalised to include cells of other types. A. J. E. W.

Saturated standard cells with small temperature coefficients. IV. Addition of various sulphates to the electrolyte of the Weston cell. W. C. VOSBURGH, P. F. DERR, G. R. COOPER, and B. PETTENGILL (J. Amer. Chem. Soc., 1939, **61**, 2687—2689).—Modified Weston cells have been prepared in which the electrolyte is saturated with two sulphates, of which one is hydrated $CdSO_4$ or a double salt of $CdSO_4$, and the temp. coeffs. have been measured. The cell made with Cd–Bi amalgam and containing Li_2SO_4 as the second sulphate has a temp. coeff. < that of the Na_2SO_4 cell (cf. A., 1939, I, 267). These cells, however, are unsuitable as standards in comparison with the Na_2SO_4 cells because they are more variable and have an e.m.f. different from saturated and unsaturated Weston cells. Extended observations indicate that the e.m.f. of the Na_2SO_4 cell is more nearly const. at const. temp. than the unsaturated Weston cell for periods of <2 years. Cells containing a second sulphate other than Li_2SO_4 and Na_2SO_4 have been investigated. W. R. A.

Kinetics of redox potentials. I—III. A. L. ROTINJAN (J. Gen. Chem. Russ., 1939, **9**, 1182—1187, 1188—1197, 1198—1206).—I. Stabilisation of the redox potentials of mixtures of H_3AsO_4 and H_3AsO_3 (in presence of KI) can be attained in acid, but not alkaline, solutions.

II. With a cathode-polarised Pt electrode, the time required for stabilisation of the potential of the system falls with rising [H·] and [I′], and with increasing [As^V]/[As^{III}] ; it is expressed by $\tau = a([H_3AsO_4]/[H_3AsO_3])^{-b}$, where a and b are consts. τ is least for platinised glass electrodes.

III. For oxidised Pt electrodes $\tau = a - b$ log [H_3AsO_4]/[H_3AsO_3], irrespective of the oxidation method applied. The E_h is ∝ [H·] of the layer of electrolyte at the surface of the electrode. R. T.

Electrical double layer at the interface of two liquids. E. J. W. VERWEY and K. F. NIESSEN (Phil. Mag., 1939, [vii], **28**, 435—446).—The potential function at the surface of two liquid phases about which a small amount of electrolyte is distributed is considered. The total potential drop D due to one phase containing excess of positive and the other

excess of negative ions consists of two parts given by $\alpha = (n_2 K_2 / n_1 K_1)^{\frac{1}{2}}$, where n = ionic concn. and K = dielectric const., and $\Delta = \epsilon D / kT$. Various special cases are considered.   T. H. G.

Electrochemical polarisation of metal electrodes. I. Mechanism of polarisation of the iron electrode. V. A. ROITER, V. A. JUSA, and E. S. POLUJAN (Acta Physicochim. U.R.S.S., 1939, **10**, 389—414).—An expression for the oscillogram of the anodic and cathodic polarisation of metal electrodes is derived, based on the mechanisms of discharge and ionisation lag, and has been investigated for Fe electrodes prepared by various methods. The deviation of the experimental oscillogram from that calc. is explained by reference to the velocity of discharge and ionisation. The surface of the electrode is polarised to an extent depending on c.d. The reason for "overpolarisation" and for the usual non-agreement of the current strength–potential curve with the equation of the discharge theory is explained. The calculation from oscillogram data of the abs. velocities of the ionisation and discharge processes is indicated. The peculiarity of the electrochemical behaviour of Fe electrodes in having a small final velocity of the ionisation and discharge processes is shown to agree with calc. vals. for metals of the Zn type.   W. R. A.

Electrochemical polarisation of metal electrodes. II. Polarisation of zinc electrode. V. A. ROITER, E. S. POLUJAN, and V. A. JUSA (Acta Physicochim. U.R.S.S., 1939, **10**, 845—858; cf. preceding abstract).—The cathodic and anodic polarisation of single crystals of Zn have been studied by an oscillographic method. The relation between polarisation overvoltage and current intensity is the same as that which holds for gas electrodes, apparent differences being due to changes in the electrode surface during polarisation. With single crystals of Zn two kinds of change may occur, viz., increase of the surface area and of the activity of the surface. The velocity of the ionisation and discharge processes at an electrode surface in equilibrium with the solution is calc. to be $\sim 10^{-10}$ g.-ion per sq. cm. per sec. The polarisation of Fe and Zn electrodes is compared.   O. J. W.

Polarisation in deposition of tin from acid solutions of its simple salts. M. LOSCHKAREV, O. ESSIN, and V. SOTNIKOVA (J. Gen. Chem. Russ., 1939, **9**, 1412—1422).—The polarisation potential π developing during electrodeposition of Sn (Sn anode, $SnCl_2$ or $SnSO_4$ electrolyte) is due initially to slowness of diffusion of $Sn^{\cdot\cdot}$ from the anode to the solution (concn. polarisation). After attainment of limiting c.d. π is determined by the rate of discharge of Sn ions at the cathode, and its val. varies with the nature of the surface of the latter. Addition of cresolsulphonic acid to the electrolyte causes chemical polarisation.   R. T.

Overvoltage on a mercury cathode in concentrated solutions of acids. I. Hydrochloric and hydrobromic acids. S. A. JOFA (Acta Physicochim. U.R.S.S., 1939, **10**, 903—912).—Measurements have been made of the overvoltage, η, at a Hg cathode in 0·1—12·5N-HCl and in 0·2—8·5N-HBr. η decreases with increasing concn. of acid. At low concns. of acid η varies linearly with log c.d., but with increasing

concn. departures from linearity are observed and the general slope of the curve changes. These anomalies are related to changes in the structure of the surface double layer due to adsorption of anions and also to the increase in the activity coeff. of the acid.   O. J. W.

Overvoltage on mercury in the presence of surface-active electrolytes. S. JOFA, B. KABANOV, E. KUTSCHINSKI, and F. CHISTIAKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 317—332).—Two methods of measuring the overvoltage on a Hg cathode are described, (a) the method of the Hg drop, (b) the method of the large Hg cathode. Using acidified solutions of Na_2SO_4, KCl, KBr, KI, and $(NBu_4)_2SO_4$, the H overvoltage on Hg and the electro-capillary curves have been investigated. The H overvoltages are decreased by surface-active anions and increased by surface-active cations, in qual. agreement with the theory advanced by Frumkin (A., 1938, 1, 201).   W. R. A.

Hydrogen overvoltage on nickel. P. LUKOVZEV, S. LEVINA, and A. FRUMKIN (Acta Physicochim. U.R.S.S., 1939, **11**, 21—44; cf. A., 1938, I, 201).— The H overvoltage on Ni has been investigated in solutions of HCl from 0·15 to 0·0003N., and of NaOH from 8·8 to 0·001N., at c.d. from 1×10^{-8} to 5×10^{-4} amp. per sq. cm. and the effect of neutral salts studied. The anodic polarisation of Ni in a H_2 atm. has been investigated in the same NaOH solutions. The results for overvoltage agree with Tafel's equation. Results are interpreted on the theory of the slow discharge of ions at the electrode.   O. D. S.

Chemical activation by gaseous ionisation. S. C. LIND (J. Chem. Physics, 1939, **7**, 790—792).— The comparative uses of the gas ion clustering hypothesis and of a free atom or free radical mechanism in reactions taking place under ionising conditions are considered.   W. R. A.

Experimental basis for the theory of quasi-unimolecular reactions. R. N. PEASE (J. Chem. Physics, 1939, **7**, 749—752).—A crit. review of reactions which have been represented as of the quasi-unimol. type indicates that the isomerisation of *cyclo*propane to propylene (Chambers et al., A., 1934, 369) is the only example which satisfies the requisite conditions. This suggests the necessity of reviewing the apparent restriction placed on the rate of activation by collision.   W. R. A.

Calculation of thermal explosion limits. D. A. FRANK-KAMENETZKI (Acta Physicochim. U.R.S.S., 1939, **10**, 365—370).—A theory of thermal explosions has been developed mathematically by which the ignition conditions may be calc. from the kinetics and heat of reaction, the dimensions of the explosion chamber, and the thermal conductivity of the reacting mixture. For the decomp. of $MeNO_3$, N_2O, and CH_2N_2 and for the oxidation of H_2S experimental and calc. vals. agree, but for the decomp. of EtN_3 the calculations fail.   W. R. A.

Polymerisation of gaseous butadiene. G. B. KISTIAKOWSKY and W. W. RANSOM (J. Chem. Physics, 1939, **7**, 725—734).—The velocity coeff. k of the dimerisation of butadiene (I) from 446° to 660° K.

$\simeq 9.20 \times 10^9$ exp $(-23,690/RT)$ c.c. mol.$^{-1}$ sec.$^{-1}$ and deviations encountered suggest an increase in activation energy with temp. The 3-vinyl*cyclo*hexene formed is converted into $\Delta^{3:3'}$-octahydrodiphenyl by addition with further (I), $k = 1.3 \times 10^{14}$ exp $(-38,000/RT)$ c.c. mol.$^{-1}$ sec.$^{-1}$. The data are in best agreement with those calc. statistically for an activated complex with the resonating structure

$(H_2\overset{.}{C}=CH=\overset{.}{C}H-CH_2-)_2$. The rôle of resonating free radicals in other reactions of dienes is briefly discussed.   W. R. A.

Kinetics of the vapour-phase reaction of *cyclo*propane with iodine. R. A. Ogg, jun., and W. J. Priest (J. Chem. Physics, 1939, **7**, 736—747).—The thermal (245—280°) and photochemical (180—230°) reactions between gaseous I and *cyclo*propane (I), studied by observation of the pressure changes in a system of const. vol., are essentially homogeneous and lead to the reversible formation of I·[CH$_2$]$_3$·I. The only important side reaction is a slow I-catalysed isomerisation of (I) to propylene. Empirical rate expressions are given, and vals. of velocity and equilibrium consts. are recorded. The formation of the free radical I·[CH$_2$]$_3$· from I and (I) is considered to be the rate-determining step with the velocity coeff. 7.36×10^{12} exp $(-17,280/RT)$ (mol./c.c.)$^{-1}$sec.$^{-1}$ For the reaction (I) $+ I_2 \rightarrow C_3H_6I_2$, $\Delta E = -17,200$ g.-cal. per mol. Taking the energy of the C–I bond as 43,000, that of the C–C bond in the (I) ring is 32,900 g.-cal. per mol.   W. R. A.

Decomposition of ethyl bromide and the collision theory of first-order reactions. F. Daniels and P. L. Veltman (J. Chem. Physics, 1939, **7**, 756—764).—The first-order thermal decomp. at ∼400° of EtBr to CH$_4$ and HBr has been studied with special reference to wall effects. Present and previous (A., 1938, I, 315) results agree with the production of Et and Br as the primary stage of decomp., followed by a series of reactions which do not involve long chains. Low-pressure effects are explained as wall effects. The decrease in the first-order rate coeff. of EtBr decomp. (and for N$_2$O$_5$ decomp.) at low pressures is not caused by the decreased no. of collisions as predicted by the collision hypothesis, but by surface effects or competing chemical reactions which become important at low pressures. A quant. re-examination of the collision hypothesis is suggested.   W. R. A.

Decomposition of acetaldehyde and deuteroacetaldehyde. R. E. Smith (Trans. Faraday Soc., 1939, **35**, 1328—1336).—Comparison of the thermal decomp. (followed manometrically) of MeCHO with that of CD$_3$·CHO suggests that more than one mechanism is involved, and that the important process is probably activation of the C–H bond. The sp. effects of C$_2$H$_4$, C$_2$H$_6$, and CO$_2$ on the reaction rate for MeCHO are studied.   F. L. U.

Inflammation of hydrocarbon–air mixtures.—See B., 1939, 1090.

Exchange of hydrogen ions between hydrogen sulphide and methyl alcohol. K. H. Geib (Z. Elektrochem., 1939, **45**, 648—650).—The exchange

of H· between H$_2$S and the OH in MeOH has been studied by rate measurements on MeOD–H$_2$S and McOH–D$_2$S mixtures at $-79°$ to $-115°$. The times of half-change at these temp. are 0.2—0.5 and 30—100 min., respectively, the change being slower from the MeOD–H$_2$S side; HCl accelerates the exchange at $-115°$. At equilibrium the MeOH contains ∼66% of the D (distribution coeff. 4—4.5). The activation energy is 7.5—8 kg.-cal. The mechanism involves transfer of H· or D· from complexes such as D$_3$S· and MeOHD· to neutral mols.   A. J. E. W.

Cracking of decalin under pressure. M. D. Tilitscheev and V. K. Schtschitikov (J. Gen. Chem. Russ., 1939, **9**, 1086—1093).—The thermostability of decahydronaphthalene (I) is $\ll$ that of C$_{10}$H$_8$, but $>$ of *n*-decane. The activation energy of cracking of (I) at 425—500° is 65,500 g.-cal. per g.-mol. The velocity coeff. is given by log $K = 15.11 - 14,330/T$.   R. T.

Reactions of organic oxygen compounds with ammonia. I. Relative rates of reaction between ketones and liquid ammonia. S. S. Dragunov (J. Gen. Chem. Russ., 1939, **9**, 693—697).—The relative rates of reaction between COMe$_2$, COMePr, COPhMe, 1-methyl*cyclo*hexan-3-one, 1-methyl*cyclo*hexan-4-one, PhCHO, and liquid NH$_3$ at 0° and atm. pressure have been determined. The rates of reaction are dependent primarily on the electrochemical character of the radicals, steric hindrance being a secondary factor. CPh$_3$·OH and CPh$_3$ did not react with NH$_3$ in the absence of catalysts.
     V. A. P

Hydrolysis of benzoic and related esters in varying media. R. A. Harman (Trans. Faraday Soc., 1939, **35**, 1336—1343).—Measurement of the effect of substituents on the consts. in the Arrhenius equation has been extended to phenylacetic and cinnamic esters (cf. A., 1938, I, 405). The transmission of such effects to the carbonyl C atom is less marked in the former than in any hitherto examined; in the cinnamic it is approx. the same as in the benzoic esters. The effect on the consts. of changing the solvent has been studied for alkaline hydrolysis of EtOBz and *m*-NO$_2$·C$_6$H$_4$·CO$_2$Et in EtOH–H$_2$O and COMe$_2$–H$_2$O mixtures; the usual relation between the temp.-independent const. and the activation energy is found.   F. L. U.

Oxidation of aldoses by hypoiodite. IV. K. Myrbäck (Svensk Kem. Tidskr., 1939, **51**, 179—192; cf. A., 1939, II, 490)—Comparative data are given on the rates of oxidation of various sugars by I in presence of varying concns. of NaOH. In general, the rates relative to that for glucose (I) are independent of [OH']. The rates for lactose, maltose, melibiose, and cellobiose are equal, and $>$ that for (I); that for *d*-galactose (II) is somewhat $>$ that for (I), whilst those for *d*- and *l*-arabinose are equal, and $>$ that for (II). The rates for *d*- and *l*-xylose are $\simeq$ that for (I); that for *d*-ribose is $<$ that for (I). The rate of oxidation of *d*-mannose is especially low, and this accounts for the difficulties sometimes occurring in its determination.   F. J. G.

Effect of periodic acid on lactic acid and its degradation products (acetaldehyde, methyl

alcohol, formaldehyde, formic acid).—See A., 1939, II, 532.

Kinetic study of the formation of *d*-glucose-phenylhydrazone. A. ORNING and G. H. STEMPEL, jun. (J. Org. Chem., 1939, **4**, 410—417).—The reaction between equilibrium *d*-glucose (I) and a mixture of NHPh·NH₂ and its hydrochloride has been followed polarimetrically in aq. solution at 30°. If all oxidising agents, including dissolved O₂, are eliminated there is no evidence of osazone formation. The forward reaction is between $NHPh·NH_3^+$ and an intermediate substance symmetrically related to the isomeric forms of (I). The reverse reaction is accelerated by acid. H. W.

Oxidation of simple sugars.—See A., 1939, II, 493.

Mutarotation of tetramethyl-α-*d*-glucopyranose and -mannopyranose.—See A., 1939, II, 494.

Exchange of chlorine substituted in aromatic compounds for amino-groups. V. Kinetics of reaction of *o*-chloronitrobenzene with aqueous ammonia. N. N. VOROSHCOV, jun., and V. A. KOBELEV (J. Gen. Chem. Russ., 1939, **9**, 1043—1046). —The velocity of the reaction $o\text{-}C_6H_4Cl\cdot NO_2 + NH_3 \rightarrow o\text{-}NH_2\cdot C_6H_4\cdot NO_2 + HCl$ ∝ concn. of substrates and ∝ temp. (log $K = 7\cdot20 - 4482/T \pm 0\cdot01$). The activation energy is 20,500 g.-cal. In presence of $CuCl_2$ the catalytic and non-catalytic reactions proceed simultaneously. R. T.

Mechanism of oxidation of organic compounds by selenium dioxide. V. Kinetics of oxidation of aldehydes. N. N. MELNIKOV and M. S. ROKITZKAJA (J. Gen. Chem. Russ., 1939, **9**, 1158—1161).— The rates of the (bimol.) oxidation by $5N\text{-}SeO_2$ in AcOH of MeCHO, EtCHO, Pr^{α}CHO, Pr^{β}CHO, heptaldehyde, and Bu^{β}CHO have been examined at 20°. The rates fall with increasing mol. wt. and from the normal to the *iso*-compound, as would be expected if the rate of reaction is dependent on the degree of enolisation of the aldehyde. G. A. R. K.

Detonation of nitrogen iodide under the action of nuclear fragments from uranium bombarded by neutrons. Experiments on other explosives. P. FABRE, C. MAGNAN, and H. MURAOUR (Compt. rend., 1939, **209**, 436—438; cf. A., 1939, I, 482).— The detonation of N iodide by neutron bombardment of adjacent U oxide has been confirmed by experiments with a high-intensity neutron generator; the time required for detonation corresponded with detonation " yields " (0·09—0·2) ≫ those of Feenberg (A., 1939, I, 426), probably owing to the use of drier specimens. No detonation was obtained under similar conditions with Pb(N₃)₂, diazo-*m*-nitroaniline perchlorate, (CH₂)₆N₄ peroxide, trinitrotriazidobenzene, or Hg fulminate. Attempts to detonate Au fulminate by fission of Au also failed.
A. J. E. W.

Emission of ultra-violet radiation and pyrolysis of ferric azide. C. RACZ (Compt. rend., 1939, **209**, 534—536; cf. A., 1939, I, 481).—Photogenic decomp. processes with activation energies (*E*) of ~47 and 33·5 kg.-cal. and an oxidation process (64 kg.-cal.) occur in Fe(N₃)₃ heated in the atm. at

>270°, 303±4°, or 334±6°, respectively. The first and third of these vals. occur with other azides; the second corresponds with decomp. of a relatively stable intermediate, as after preliminary heating at 310° decomp. occurs at ≮305° (*E* = 34 and 75 kg.-cal.). Detonation occurs at 200° in a closed space and at 230° in a current of N₂, in which max. emission occurs ~20° below the detonation temp. owing to the inhibiting effect of Fe. A. J. E. W.

Kinetics of crystal growth. S. ROGINSKI (Acta Physicochim. U.R.S.S., 1939, **10**, 825—844).—Theoretical. The kinetic equations of free growth of a single crystal are derived. The conditions favouring different types of growth and the growth of a plane cryst. film are discussed and compared with existing experimental data. O. J. W.

Co-operative activation. W. E. GARNER (Nature, 1939, **144**, 287).—Reactions in organised condensed systems occurring with activation energies > those normally associated with the temp. range at which the reactions occur, e.g., the denaturation of proteins, the decomp. of $CaCO_3,6H_2O$, and the production of detonation nuclei in solid explosives, are discussed. The rapid rates of these abnormal processes are attributed to co-operative activation of a no. of points, *n*, on the surface within a short time interval, the activation energy required at each point being E/n, where E is the measured activation energy.
L. S. T.

Garner principle of co-operative activation. F. G. DONNAN (Nature, 1939, **144**, 446).—The Garner principle (preceding abstract) should be of val. in interpreting many catalytic phenomena, including reactions that occur in the operation of enzymes and co-enzymes. L. S. T.

Reaction kinetics in processes of nucleation and growth. W. A. JOHNSON and R. F. MEHL (Amer. Inst. Min. Met. Eng. Tech. Publ. No. 1089, 1939, 27 pp.; Met. Tech., 1939, **6**, No. 5).—An analytical expression is derived for the rate of reaction of a reaction proceeding by nucleation and growth when nucleation (*a*) occurs without regard for matrix structure and the nuclei tend to grow into spherical nodules, and (*b*) when nucleation is restricted to the grain boundaries and the nuclei tend to grow to hemispherical nodules. R. B. C.

Influence of organic peroxides on the cool flame of butane. E. J. BLAT, M. J. GERBER, and M. B. NEUMANN (Acta Physicochim. U.R.S.S., 1939, **10**, 273—296).—The decomp. of (EtO)₂ and MeO₂H is accelerated by increase in pressure up to a crit. pressure, p_k, which decreases with decrease in temp. At pressures > p_k decomp. is explosive. Decomp. cannot be ascribed to a thermal process but proceeds by chain mechanism. (EtO)₂ and MeO₂H reduce the induction period of the cool flame in C₅H₁₂–O₂ mixtures. The data afford further proof of the theories of Neumann and his co-workers (cf. A., 1936, 1344, 1468, and subsequently) on the formation of cool hydrocarbon flames, combustion, which is brought about by peroxide decomp., proceeding in two stages.
C. R. H.

Mechanism of the oxygen effect on hydrogen bromide reacting with ethenoid compounds.—See A., 1939, II, 530.

Decomposition of hydrogen peroxide by catalase. F. H. JOHNSON and K. L. VAN SCHOUWENBURG (Nature, 1939, **144**, 634—635).—Experiments showing that this decomp. can occur under anaërobic conditions are described. L. S. T.

Reaction of α-thiocyanopropionic acid with water. A. FREDGA (Arkiv Kemi, Min., Geol., 1939, **13**, A, No. 5, 18 pp.).—The pseudo-unimol. reaction : $SCN \cdot CHMe \cdot CO_2H$ (I) $+ H_2O \rightarrow NH_2 \cdot CO \cdot S \cdot CHMe \cdot CO_2H$ has been studied polarimetrically at 25° in aq. solution containing $\not< 0.5$N-strong acid. Under these conditions (I) is practically non-ionised, and the formation of $SH \cdot CHMe \cdot CO_2H$ and 2 : 4-diketo-5-methylthiazolidine is negligible. In 0·53N-HCl the effect of KCl is given by : $k \times 10^4 = 7.03$—0·92[KCl]. The salt effect of NaCl is smaller, in contradiction of the Brönsted theory. In 0·28N-KHal, k increases very rapidly with concn. of the corresponding HHal.: $HI \gg HBr > HCl$. Although $\log (k - k_0) \propto$ [HCl], no simple relation can be found for HBr and HI. The effects are ascribed to catalysis by the undissociated acids. In 0·28N-KF addition of HF gives a min. val. of k at [HF] $= 7$—9. At low [HF] vals. of k lie above those for corresponding [HCl] etc., and tend towards a much larger k_0. This is due to catalysis by HF_2' ions, KHF_2 being very active at low concns. For [HCl] $= 0.53$ and [KCl] $= 0.28$ the temp. coeff. is given by : $\log k = 11.446$—$4356/T$. The mechanism of the reaction is discussed. M. H. M. A.

Effect of nuclear and side-chain substitution on the oxonium ion catalysed iodination of acetophenone derivatives. L. ZUCKER and L. P. HAMMETT (J. Amer. Chem. Soc., 1939, **61**, 2779—2784).—The rates of iodination of COPhMe, p-$C_6H_4Br \cdot COMe$, p-$C_6H_4Me \cdot COMe$, 2 : 4 : 6-$C_6H_2Me_3 \cdot COMe$ (I), COPhEt, COPhPr$^\alpha$, and COPhPr$^\beta$ in 1·388M. aq. $HClO_4$, and COPhMe in 0·210M. aq. $HClO_4$, have been measured by a colorimetric method. The data agree with those reported for the bromination of some of these ketones in 75% AcOH–H_2O solutions 0·5M. to HCl (cf. A., 1935, 1209), the effect on the rate of iodination of substitution of a Me group for H in the side chain being $\gg$ the effect of substitution in the ring. No steric hindrance was found in the iodination of (I). W. R. A.

Mechanism of the acid-catalysed enolisation of acetophenone derivatives. L. ZUCKER and L. P. HAMMETT (J. Amer. Chem. Soc., 1939, **61**, 2785—2791; cf. preceding and following abstracts).—The basic ionisation consts. of COPhEt, COPhPr$^\alpha$, and COPhPr$^\beta$ have been measured. The iodination of COPhMe shows a general acid catalysis. The rate-determining step in the acid-catalysed enolisation of ketones is proton removal. W. R. A.

Kinetics of the iodination of acetophenone in sulphuric and perchloric acid solutions. L. ZUCKER and L. P. HAMMETT (J. Amer. Chem. Soc., 1939, **61**, 2791—2798; cf. preceding abstract).—The rate of iodination of COPhMe in 2 to 30% aq. $HClO_4$ and in 0·5 to 66% aq. H_2SO_4 is determined by the

rate of enolisation in the more dil. solutions and by the rate of reaction of the enol with I in acid solutions containing $>51\%$ H_2SO_4. At intermediate concns. the two rates are approx. equal. The rate of enolisation, however, even in aq. $HClO_4$, is $\propto c_{OH,+}$ over a wide range. W. R. A.

Steric nature of the *ortho* effect in the hydrogen exchange reactions of aromatic tertiary amines. W. G. BROWN, A. H. WIDIGER, and N. J. LETANG (J. Amer. Chem. Soc., 1939, **61**, 2597—2601).—The theory of the *ortho* effect states that the inhibition of the H_2-exchange reactions of $NPhMe_2$ and its derivatives is a steric effect concerned with the tendency of an o-substituent to block the formation of quinonoid structures. This has been tested experimentally by two independent methods : (i) by varying the size of the o-substituent, and (ii) by an argument that if the amino-N atom is linked with the o-C so as to form a 5-membered ring which would be necessarily coplanar with the Ph ring, there should be no *ortho* effect. The results are consistent with predictions. Thus the inhibition by an o-F of H lability is $\ll$ by an o-Cl. Further, N-methylindoline and N-methyltetrahydroquinoline (dicyclic coplanar structures) exchange H readily, whilst N-methylhomotetrahydroquinoline, the heterocyclic ring of which must be highly puckered (7-membered), exhibits the inhibition of reactivity which is characteristic of o-substituted *tert.* amines. W. R. A.

Kinetics of the exchange of oxygen between benzoic acid and water. I. ROBERTS and H. C. UREY (J. Amer. Chem. Soc., 1939, **61**, 2580—2584).—The rate of exchange of ^{18}O between BzOH and H_2O has been studied at 80° in dil. aq. solution using HCl as catalyst. The reaction has been followed by decomp. samples of BzOH, crystallised out from the reaction mixture, into C_6H_6 and CO_2 and analysing the CO_2 in a mass spectrometer. The rate is of the first order with respect to the difference in $[^{18}O]$ of the reactants, first order with respect to $H^{\cdot}$ ion, independent of BzOH, and free from salt effects (KCl). The similarity between this reaction and the acid-catalysed esterification and ester hydrolysis reactions is indicated (cf. following abstract). W. R. A.

Mechanism of acid-catalysed ester hydrolysis, esterification and oxygen exchange of carboxylic acids. I. ROBERTS and H. C. UREY (J. Amer. Chem. Soc., 1939, **61**, 2584—2587; cf. preceding abstract).—A combination of recent ^{18}O investigations with recorded kinetic data for acid-catalysed ester hydrolysis, esterification and O exchange of carboxylic acids suggests that all three reactions have the same mechanism. Taking as a basis the fact that these reactions are acid-catalysed and of first order in H_2O or EtOH, the compositions of the reactive complexes the disappearances of which control the reaction rates have been determined. Only three of the proposed mechanisms yield the crit. complex required by the kinetics. The criterion of pre-equilibrium in H_2O and D_2O proposed by Bonhoeffer and Reitz (A., 1937, I, 469) is not applicable since the simple two-step mechanism assumed is incorrect for the present reactions. W. R. A.

Racemisation of optically active α-alkylsulphonylpropionic acids. A. MELLANDER (Arkiv Kemi, Min. Geol., 1939, **13**, A, No. 3, 30 pp.).—k data are given for the racemisation of 0·05—0·2N-α-methyl-, -ethyl-, -n-propyl-, and -isopropyl-sulphonylpropionic acids (I) in various aq. media at 25°; E vals. are derived from supplementary measurements at 35°. In acids (HCl, HBr, HClO₄, concn. c) k is max. for $c = \sim 0\cdot04$N. and falls with increasing c, the variation being linear over certain ranges; an anion effect thus operates, the effect of the ions decreasing in the order ClO₄′, Br′, Cl′. The effect of adding salts with a common anion corresponds with the increased anion concn., and H˙ has no unique effect on the racemisation. Data for aq. and partly neutralised solutions show that k decreases with c at [H˙] < $\sim 0\cdot04$N., and is min. at $p_H \sim 6$. The data for strongly acid solutions indicate the predominance of base catalysis by H₂O, acting on (I) mols., and k is determined by the relation between the f vals. for (I) and the transition complex. At lower acidity changes in the dissociation of (I) introduce other mechanisms, involving base catalysis by the (I) anion itself acting on the undissociated mol., and a less important base effect of H₂O on the anion. Racemisation is rapid in alkaline solution and a marked positive salt effect, which is ∝ concn., occurs; k ∝ [OH′], indicating catalysis by OH′, but base catalysis of the general type also occurs to a small extent.   A. J. E. W.

Racemisation of optically active α-phenylsulphonylpropionic acid. L. RAMBERG and I. HEDLUND (Arkiv Kemi, Min. Geol., 1939, **13**, A, No. 1, 36 pp.).—Measurements of the rate of racemisation are described, and k data for 0·1N-PhSO₂·CHMe·CO₂H (I) in various aq. media at 25° are recorded and discussed; E vals. are deduced from measurements at 35°. A strong anion effect is observed in acid solutions, k showing a linear decrease with increasing acid concn. over limited ranges (HCl 0·1—1·0, HBr 0·1—1·2, HClO₄ 0·05—0·5N.); in presence of salts with a common anion the k vals. are only slightly < those for acids of equiv. anion concn., the nature of the cation having little effect. The effectiveness of the anions studied decreases in the order ClO₄′, I′, (Br′, NO₃′), Cl′. The kinetic results do not differentiate between base catalysis of racemisation of undissociated (I) and acid catalysis acting on the anion, but the former mechanism is preferred owing to the potentially acidic character of (I); activity effects are considered in detail. A base catalytic effect of H₂O, acting on both the undissociated mol. and its anion, accounts for the k changes on addition of non-electrolytes, change of the [(I)], and partial neutralisation of the (I). In neutral solution the effect of OH′ predominates. Vals. of the rate consts. for the four processes are compared.   A. J. E. W.

Acid catalysis in liquid ammonia. III. Catalysis of the reaction of ammonolysis of santonin by acid amides, phenols, and other weak acids. G. S. MARKOVA and A. I. SCHATTENSTEIN. **IV. Kinetics of the ammonolysis of pilocarpine in liquid ammonia in the presence of ammonium salts.** A. I. SCHATTENSTEIN and G. S. MARKOVA (Acta Physicochim. U.R.S.S., 1939, **11**, 117—130, 131—151; cf. A., 1937, I, 251).—III. The catalytic activity of NH₄ salts of weak mineral and carboxylic acids, phenols, carboxyl-amides and -imides, derivatives of aquo- and ammono-carbonic· acids, nitroaniline, MeNO₂, and carbazole have been investigated and correlated with the acidic character of solutions of these compounds in liquid NH₃.

IV. The reaction of pilocarpine with liquid NH₃ is accompanied by a lowering of sp. rotation. The rate of reaction has been studied polarimetrically at 0°, 10°, 20°, and 30° in the presence of a no. of NH₄ salts. The reaction is pseudo-unimol. The influence of 2N-NaBr, -NaNO₃, -NaI, and -NaClO₄ on the reaction in presence of NH₄Cl and NH₄Br has been studied. The catalytic activity of the NH₄ salts depends on the nature of the anions present. The anion activities are in the order Cl′ > Br′ > NO₃′ > I′ > ClO₄′.   O. D. S.

Kinetics of the reaction between ammonia and nitric oxide on the surface of a platinum catalyst. E. A. MICHAILOVA (Acta Physicochim. U.R.S.S., 1939, **10**, 653—676).—The kinetics of the reaction $2NH_3 + 3NO = 2\cdot5N_2 + 3H_2O$ were investigated at 500—530° K. and at ~2 cm. pressure. With equiv. quantities of the gases, or with excess of NO, the reaction proceeds according to the stoicheiometric equation, but complications occur with excess of NH₃. The reaction velocity is independent of the pressures of each individual gas, but depends on the ratio of the pressures. The velocity reaches a max. at a certain proportion of both gases, and with equiv. amounts of the gases remains const. for the first 40—50 min. The reaction mechanism is discussed and the equation $dp_{N_2}/dt = (p_{NH_3}p_{NO})/(\alpha p_{NH_3} + \beta p_{NO})^2$ is deduced for the rate of reaction. From data obtained over the above temp. range, the apparent energy of activation is 24·8 kg.-cal. The time for quarter change when the reaction occurs under industrial conditions (1000°, 10% NH₃, pressure ~7 cm.) was calc. to be 10^{-9} sec. In practice, however, the reaction is hindered by the powerful adsorption of O₂ on the Pt.   A. J. M.

Hydrogenation of iron nitrides. B. N. JEROFEEV (Acta Physicochim. U.R.S.S., 1939, **10**, 313—315).—The conclusions reached by Morozov and Kagan (cf. A., 1939, I, 33) as a result of their experiments on the poisoning of Fe catalysts in the synthesis of NH₃ are adversely criticised.   C. R. H.

[Hydrogenation of iron nitrides.] M. KAGAN (Acta Physicochim. U.R.S.S., 1939, **10**, 935—936).—A reply and criticism (cf. preceding abstract).   O. J. W.

Kinetics of cyclisation of diisobutyl at platinised charcoal catalyst. B. A. KAZANSKI and A. L. LIBERMAN (J. Gen. Chem. Russ., 1939, **9**, 1431—1434).—The apparent activation energy of the reaction Bu$^β_2 \rightarrow$ 1 : 4-dimethylcyclohexane (I) (Pt–C catalyst, at 300°) is practically identical with that of the further reaction (I) → p-xylene. The velocity of evolution of H₂ during the initial 30—40 min. of both reactions is > during the succeeding periods.   R. T.

Relationship between energy of activation and activity of catalysts. A. D. CHVATOV (J. Gen. Chem. Russ., 1939, **9**, 819—824).—The activity of a 1 : 1 Ni–Al_2O_3 catalyst for the reaction $MeCHO \rightarrow CH_4 + CO$ was halved by passing small amounts of CO at 100°, but the activation energy was unaffected. It is concluded that the active centres occupy only a very small part of the catalyst surface.   R. T.

Oxidation of stearic acid by oxygen. L. H. BRIGGS and B. W. THOMAS (New Zealand J. Sci. Tech., 1939, **21**, 47—52B).—The rate of absorption of O_2 by stearic acid at 100° is increased by Co stearate, V_2O_5, and Ni, Pb, Cu, and Mn stearates in that order of descending activity. All the oxidised acids give a positive Fellenberg test, but none a positive Kreis test. The peroxide val. of the oxidised acids decreases with increasing O_2 absorption. Theoretical implications of the results are discussed.   C. S. W.

Catalysed polymerisation of butadiene at a liquid–gas interface. G. GEE, C. B. DAVIES, and H. W. MELVILLE (Trans. Faraday Soc., 1939, **35**, 1298—1312).—The polymerisation has been studied at the surface of aq. H_2O_2 by following the change in surface tension (γ), the relation between γ and the surface concn. of polymeride having been previously determined. The rate of polymerisation $\propto [H_2O_2]$ and the partial pressure of butadiene. Analysis of the data shows that the life of the active polymeride is shorter than the reaction time. The complex so formed starts a polymerisation chain which is broken by some deactivating collision different from that which initiates the propagation.   F. L. U.

Vapour-phase catalytic oxidation of organic compounds. Production of tolualdehyde and phthalic anhydride from xylene.—See B., 1939, 1098.

Fischer–Tropsch [catalytic] synthesis of hydrocarbons.—See B., 1939, 1097.

Catalytic hydration of olefines.—See B., 1939, 1097.

Catalysts for coal hydrogenation.—See B., 1939, 1088.

Conversion of carbon monoxide by water vapour on iron catalysts.—See B., 1939, 1089.

Cathodic production of hydrogen peroxide.—See B., 1939, 1140.

Electrodeposition of lead from solutions of lead sulphamate.—See B., 1939, 1132.

Electrodeposition of metals from solutions containing sulphamic acid and its salts.—See B., 1939, 1132.

Formation of formaldehyde by electrolysis of acetate.—See A., 1939, II, 533.

Electrolysis of mixtures of pivalates with nitrates.—See A., 1939, II, 532.

Mechanism of the recombination of the hydroxyl radical in the electric discharge through water vapour. V. KONDRATEEV (Acta Physicochim. U.R.S.S., 1939, **10**, 791—804).—In the electrical discharge through H_2O vapour OH radicals disappear to about an equal extent by the two processes :

$2OH + M = H_2O_2 + M$,   and $OH + H + M = H_2O + M$. At high temp. the reaction $OH + H = H_2 + O$ also occurs and becomes predominant above 300°.   O. J. W.

Volume and surface processes during the oxidation of nitrogen in a glow discharge. I. B. A. KONOVALOVA and N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1939, **10**, 631—652; cf. A., 1939, I, 480).—The process is a combination of a vol. and a wall process, the latter being poisoned by polar mols. The investigation of the effect of polar mols. thus provides a method of separating the two processes. At low pressures 60% of the NO is produced by the wall process. Toxic mols. do not affect the spectrum of N_2. Activating mols., such as CO and CO_2, affect the spectrum and therefore influence the vol. process. The dissociation of NO in the discharge is not poisoned by H_2O, and hence is not a wall reaction. The results differ from those of Westhaven et al. (A., 1930, 553), the differences being explained.   A. J. M.

Volume and surface processes during the oxidation of nitrogen in a glow discharge. II. B. A. KONOVALOVA and N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1939, **10**, 813—824; cf. A., 1939, I, 480).—The wall catalytic process occurring during the oxidation of N_2 in a glow discharge is probably a reaction of N_2^+ ions with adsorbed O_2^- ions, and at very low pressures the electrical oxidation of N_2 is wholly due to this reaction. H_2O vapour poisons the wall process, but also has a positive catalytic effect on the vol. reaction in the gas space, especially in the O_2 region. Addition of CO and CO_2 to the gas produces an activating effect on the vol. reaction which is clearly reflected in the emission spectrum of the discharge.   O. J. W.

Oxidation of a graphite electrode in very dilute water vapour in the glow discharge. V. SIHVONEN and R. NÄSÄNEN (Suomen Kem., 1939, **12**, B, 25—26).—The primary product is CO, part of which is further oxidised to CO_2.   F. J. G.

Inversion of sucrose in an ultra-high-frequency field. S. P. VOSKRESENSKI and E. N. MALASCHENKO (J. Gen. Chem. Russ., 1939, **9**, 1118—1120).—Hydrolysis of sucrose, in presence or absence of HCl, is unaffected by maintaining the solutions in a high-frequency field ($\lambda = 3$—12 m.).   R. T.

Carbon monoxide–oxygen flame. VI. **Photochemical oxidation of CO near the region of self-inflammation.** H. KONDRATEEVA and V. KONDRATEEV (Acta Physicochim. U.R.S.S., 1939, **10**, 805—812; cf. A., 1939, I, 569).—Using a streaming method a mixture of $CO + 3O_2$ at 90 mm. was exposed to the light of an Al spark at 224—490°. Up to 400° the rate of photo-oxidation of CO is practically independent of temp., but increases rapidly as the temp. approaches that of self-inflammation, viz., between 442° and 490°. The rates of the photochemical and of the dark reactions are compared and the no. of initial centres for the latter is calc.   O. J. W.

Decomposition of hydrogen peroxide by potassium ferrocyanide. I. B. B. LAL (J. Indian Chem. Soc., 1939, **16**, 321—332).—Aq. $K_4Fe(CN)_6$ (I)

is photodecomposed by bright sunlight, producing K aquopentacyanoferrite up to a max. concn. in the photochemical equilibrium (I) + $H_2O \rightleftharpoons$ KCN + $K_3Fe(CN)_5,H_2O$ (II). (II) is very effective in decomp. H_2O_2. Thus when a mixture of (I) + H_2O_2 is illuminated by bright sunlight, (II) is removed immediately it is formed, and more (II) is produced by the photochemical reaction until all the H_2O_2 is used up. The after-effect observed in the decomp. of H_2O_2 by (I) after exposure is thus due to the reversible formation of (II), which decomposes H_2O_2 in the dark with a uniformly high velocity in presence of excess of (I), and not to the formation of colloidal $Fe(OH)_3$ or $Fe^{\cdots}$ ion. The presence of (I) greatly increases the decomp. activity of (II) owing to the oxidation of ferrite to ferrate by H_2O_2, and to the reduction of ferrate to ferrite by the excess of (I). The greater is the time of exposure of the mixture (I) + H_2O_2, the greater is the val. of the velocity coeff., whereas aq. (I), illuminated prior to its mixing with H_2O_2 in the dark, decomposes H_2O_2 with a velocity coeff. independent of the time of exposure. A mechanism of the decomp. of H_2O_2 by aq. (I), based on these observations, has been outlined. W. R. A.

Optical sensitisation of silver halides. VII. Spectral sensitivity and absorption spectrum of sensitised layers of silver bromide. S. NATANSON (Acta Physicochim. U.R.S.S., 1939, 11, 67—74; cf. B., 1937, 1137).—The absorption curves of erythrosin, phloxine, rhodamine B, and iodoeosin adsorbed on transparent sublimed layers of AgBr have been measured and shown to correspond exactly with the sensitivity curves for the same systems. O. D. S.

Cadmium-photosensitised reactions of ethane. E. W. R. STEACIE and R. POTVIN (J. Chem. Physics, 1939, 7, 782—789; cf. A., 1938, I, 632).—The Cd-photosensitised decomp. of C_2H_6 and the Cd-photosensitised reactions of C_2H_6–H_2 mixtures have been investigated. The data indicate that the primary stage involves the rupture of a C–H bond (as for the Hg-photosensitised reactions), probably by Cd ($^3P_1$) + C_2H_6 = CdH + Et. The products are H_2, CH_4, C_3H_8, C_4H_{10}, and higher hydrocarbons. The CH_4 probably results from the Me radicals formed by H + Et → 2Me, and the higher hydrocarbons from recombination of radicals. The Cd-photosensitised decomp. of C_3H_8 and C_4H_{10} is considered. W. R. A.

Photochemical decomposition of benzene vapour. I. G. I. KRASSINA. **II.** N. A. PRILESHAEVA (Acta Physicochim. U.R.S.S., 1939, 10, 189—192, 193—198).—I. The photodissociation of C_6H_6 vapour according to $C_6H_6 + h\nu \rightarrow$ Ph + H has been established by detecting at. H. Of λλ 1850—2300 A. the range 1850—2000 A. is the most effective.

II. The increase in H_2 pressure with time due to the recombination of at. H has been investigated. For the ranges 1850—2000 A. and 2000—2150 A. the no. of C_6H_6 mols. dissociating per sec. is 1.55×10^{13} and 0.29×10^{13} respectively. Assuming that λλ 1990—2150 A. cause predissociation whilst λλ <1990 A. produce direct decomp., the probability of direct decomp. is five times that of the predissociation process. C. R. H.

Effect of temperature on the predissociation of photoactivated acetaldehyde molecules. G. K. ROLLEFSON and D. C. GRAHAME (J. Chem. Physics, 1939, 7, 775—779).—By measuring the quantum yields of the photochemical reaction it is found that at room temp. the no. of free radicals produced in MeCHO by the absorption of 2652 A. is > the no. produced by 3132 A. Increase in temp. causes a relative increase in radical yield at 3132 A. until at 100° the yields are equal. At still higher temp. the yield with 3132 A. is > with 2652 A. This temp. effect is explained by assuming that at 3132 A. the dissociation is aided by thermally-excited vibrational energy, and this is supported by the observation that rise of temp. causes the fluorescence to fade in a way analogous to the increase in dissociation. Evidence for thermally-induced predissociation with 2652 A. is lacking, and the lower efficiency of production of free radicals with this λ is attributed to a difference in the electronic states attained by MeCHO excited by the two λλ. W. R. A.

Photochemical production of reducing sugars from glycosides by ultra-violet light. L. J. HEIDT (J. Amer. Chem. Soc., 1939, 61, 2981—2982).—Ultra-violet light is absorbed by fructosides and glucosides with liberation of reducing sugars. A special arrangement of apparatus for this purpose has been devised, and some preliminary details of the photochemical production are given. W. R. A.

Explanation of mitogenetic radiation as " sensitised fluorescence." A. GURVITSCH and L. GURVITSCH (Acta Physicochim. U.R.S.S., 1939, 10, 719—724).—Frankenburger's theory, that energy made available in org., and particularly fermentation, reactions taking place by intermediate formation of atoms and radicals, can be used to excite mols. of other substances present giving rise to mitogenetic radiation, has been confirmed experimentally. When glycine, previously irradiated, was mixed with glucose undergoing fermentation, the characteristic glucose bands at 1900—1905 and 1915—1920 A. were excited. No fermentation product could act as the receptor in this case. Na˙ and Cl′ can act as receptors. The bearing of these results on mitogenetic spectral analysis is discussed. A. J. M.

Polymerisation processes induced by mitogenetic radiation. A. GURVITSCH and L. GURVITSCH (Acta Physicochim. U.R.S.S., 1939, 10, 711—718).—When a freshly prepared 10% peptone (I) solution is irradiated with mitogenetic radiation a substance is produced which reacts with gastric juice, whilst the original (I) does not. If the peptone solution is shaken with kaolin, the latter separated, and the solution is then irradiated, the same effect is obtained, but if the shaking with kaolin is carried out after the irradiation, there is no effect. The absorption of irradiated (I) in the range 2800—2450 A. is considerably > that of the original substance. These phenomena point to the formation of a polymeride under the influence of the radiation. The concn. of the polymeride, within certain limits, ∝ that of the original peptone solution. The polymerisation of a dipeptide (glycylglycine) by mitogenetic radiation was also investigated. After irradiation the product had

no effect on gastric juice, but a positive effect was obtained after the addition of a small amount of serum-albumin.   A. J. M.

Mitogenetic radiation during the formation of sparingly soluble precipitates. A. I. RABINERSON and M. A. VLADIMIRSKAIA (Acta Physicochim. U.R.S.S., 1939, 10, 859—866; cf. A., 1939, I, 118).—During the pptn. of many sparingly sol. salts [$e.g.$, $BaSO_4$, $BaCrO_4$, $CaCrO_4$, $Cu_2Fe(CN)_6$, $Zn_2Fe(CN)_6$] ultra-violet mitogenetic radiation is emitted. The spectral distribution of the radiation is characteristic of the particular salt and probably of the anion. The mechanism of the process is discussed.   O. J. W.

Hydrolysis of starch films by polarised infrared radiation. E. S. SEMMENS (Nature, 1939, 144, 379—380; cf. A., 1935, 132).—Photographs showing the hydrolysis of starch grains by exposure to polarised radiation from a heated Pt gauze are reproduced.   L. S. T.

Rupture of macro-molecules by ultrasonic waves. G. SCHMID and O. ROMMEL (Z. Elektrochem., 1939, 45, 659—661).—Exposure of PhMe solutions of polystyrenes (mol. wt. 195,000—850,000) to a powerful source of ultrasonic waves causes a decrease of the mean mol. wt. (determined viscosimetrically) towards a const. limiting val. (~30,000), illustrating the breakage of chemical linkings by the waves. The decrease of mol. wt. is rapid in the first 30 min., but becomes slower on further exposure. Similar effects are observed with other solvents, and in solutions of guncotton and polyacrylic esters.   A. J. E. W.

When is a substance oxidised, reduced, electro-oxidised, or electro-reduced? H. G. BOS (Chem. Weekblad, 1939, 36, 671—675).—The various ideas covered by the terms oxidation and reduction are discussed and it is shown how in many cases contradictory results may be obtained according to the definition accepted.   S. C.

Chemistry of the " inert " gases. II. Hydrates of argon and neon. III. Chemical methods of separation of " inert " gases from their mixtures. B. A. NIKITIN (J. Gen. Chem. Russ., 1939, 9, 1167—1175, 1176—1181).—II. Mixed crystals of $SO_2,6H_2O$ (I) and $A,6H_2O$ are obtained by leaving A in contact with (I) and ice, at —10·5°, for several days. The partition coeff. for A in these conditions is 78×10^{-4}, as compared with 0.57×10^{-4} for Ne. Under analogous conditions He was not found in the crystals.

III. Mixtures of inert gases are separated by a method depending on fractional co-deposition with (I), in the above conditions.   R. T.

Copper azide and its complexes. A. CIRULIS (Naturwiss., 1939, 27, 583).—The prolonged action (2 months) of 2% HN_3 on fine Cu powder gave pure anhyd. Cu azide as small, blackish-violet, rhombic crystals. The substance explodes when struck or rubbed; explosion point 202°. From CuO or $Cu(OH)_2$ in contact with 2% HN_3, CuN_6 was obtained in the form of smaller, moss-green crystals. This salt, when dry, is much more explosive than the first. Two basic Cu azides were prepared which were less ex-

plosive. 87 complex Cu azides with NH_3, amines, and various org. bases have been prepared. The co-ordination no. is usually 4 or 3, more rarely 6 and 2 Most of the complexes are explosive.   A. J. M.

Copper periodates. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, 16, 269—272).—Dropwise addition of aq. paraperiodic acid, $HIO_4,2H_2O$, to an aq. suspension of $CuCO_3$ (a), and boiling a suspension of disodium paraperiodate, $Na_2H_3IO_6$, with excess of aq. $CuSO_4$ (b), both yielded cryst. yellow-green cupric paraperiodate, Cu_2HIO_6 or $Cu_4I_2O_{11},H_2O$, which does not lose wt. when heated at 120° in an air oven or at 110° in vac. Method (a) does not yield $Cu_5(IO_6)_2,5H_2O$. Dropwise addition of $HIO_4,2H_2O$ to dil. aq. $Cu(OAc)_2$ gave deep green Cu^{II} paraperiodate heptahydrate, $Cu_5(IO_6)_2,7H_2O$ (I) but not Cu^{II} metaperiodate, $Cu(IO_4)_2$. (I) does not lose wt. in an air oven at <70° but at 74° is slowly dehydrated to $Cu_5(IO_6)_2,5H_2O$ (II). Between 74° and 120° there is no further loss in wt. The v.p. of (I) and (II) at 74° are 5 and 3 mm. respectively.   W. R. A.

Reaction of some xanthic acids with metallic salts.—See A., 1939, II, 532.

Co-ordination compounds with 8-aminoquinoline as a chelate group.—See A., 1939, II, 521.

Action of gaseous ammonia on anhydrous or hydrated magnesium chloride. L. J. OLMER and (MLLE.) M. L. QUINET (Compt. rend., 1939, 209, 513—516).—MeOH, EtOH, or Pr^aOH solutions of anhyd. $MgCl_2$ yield cryst. $[Mg(NH_3)_6]Cl_2$ (I) on treatment with NH_3; (I) is slowly converted into $[Mg(H_2O)_6]Cl_2$ (II) by H_2O vapour, and forms $MgCl_2,4NH_3$ or $MgCl_2,2NH_3$ in a vac. at 15° or 111°, respectively. Pure anhyd. $MgCl_2$ is conveniently prepared by heating (I) at 800° in absence of air. At 15—111° NH_3 converts (II) into NH_4Cl and $Mg(OH)_2$; alcoholic solutions afford the same products at 70°, but at —20° to 20° $[Mg(NH_3)_5(H_2O)]Cl_2$ or $[Mg(NH_3)_3(H_2O)_3]Cl_2$ is formed, according as the concn. of (II) is < or >6%.   A. J. E. W.

Thermal behaviour of compounds important in analytical practice. I. Calcium oxalate monohydrate. J. KRUSTINSONS (Z. anal. Chem., 1939, 117, 330—332; cf. A., 1938, I, 370; 1939, I, 90).—Data showing the effect of temp. and time of heating on the loss of H_2O from CaC_2O_4,H_2O (I) over the range 120—150° are recorded. After heating for 4 hr. at 130°, the loss in wt. on 0·5463 g. of (I) is 0·24 mg. or 0·04%. A temp. of 130° can be safely used for drying (I), and fluctuations in temp. to 150° of short duration can be disregarded. The temp. of 200° for complete expulsion of H_2O is confirmed. The decomp. of CaC_2O_4 begins at 430°.   L. S. T.

Calcium silicides. V. LOUIS and H. H. FRANCK (Z. anorg. Chem., 1939, 242, 117—127).—By the action of Ca on Si (2Ca : 1Si) at ~1050° in a stream of CO_2, rapid cooling, and treatment of the product with an EtOH solution of NH_4Cl, Ca_2Si_2 (98%) was obtained. X-Ray measurements show that Ca_2Si_2 can be prepared in two forms, which by appropriate heat-treatment are mutually interconvertible. Ca_2Si_2

is not converted into $CaSi_2$ by heating. By the action of Ca on Si (4Ca : 1Si) the *compound* Ca_2Si, which has a cubic structure, a 4·7 A., was obtained.
O. J. W.

Calcium silicides and nitrogen. H. H. FRANCK and V. LOUIS (Z. anorg. Chem., 1939, **242**, 128—137; cf. preceding abstract).—$CaSi_2$ reacts with N_2 at high temp. to form $Ca(SiN)_2$, the stability of which is governed by the temp.-dependent equilibrium $Ca(SiN)_2 \rightleftharpoons CaSiN_2 + Si$. Ca_2Si_2 reacts with N_2 at ~1200° according to : $Ca_2Si_2 + 2N_2 = 2CaSiN_2$. Pure $CaSiN_2$ can be prepared in this way.
O. J. W.

Basic phosphates of bivalent metals. IV. Strontium hydroxyapatite. R. KLEMENT (Z. anorg. Chem., 1939, **242**, 215—221; cf. A., 1938, I, 320).—Sr hydroxyapatite, $Sr_{10}(PO_4)_6(OH)_2$ (I), can be prepared in an impure state by hydrolysis of $SrHPO_4$ with 0·1N-NaOH or with a phosphate buffer solution (p_H 11·0), and by pptn. of Sr salts with alkaline phosphate solutions. It is obtained pure by heating $Sr_3(PO_4)_2$ with $SrCO_3$ in a stream of H_2O vapour at 1150°. X-Ray measurements show that (I) crystallises in the hexagonal form, a 9·74, c 7·20 A., and is isomorphous with the corresponding Ca, Ba, and Pb compounds.
O. J. W.

Corrosion of zinc.—See B., 1939, 1128.

Formula and analysis of the cadmium cyanide complex. N. HALL (Metal Ind., N.Y., 1939, **37**, 404—406).—The equilibrium ratio CdO : NaCN is 1 : 3·8, indicating that the factor 1·74 is sufficiently accurate for calculating the combined NaCN from the Cd content. Owing to the presence of NH_3 from the decomp. of NaCN, the determination of free CN′ by titration with $AgNO_3$ in presence of KI gives high results. A method for determining total cyanide by titration with $AgNO_3$ after the addition of aq. NH_3 is described.
L. S. T.

Chemistry of boron hydrides. I. Structure of boron hydrides. II. Reactions of diborane and derivatives. A. J. E. WELCH (Chem. and Ind., 1939, 869—872, 937—940).—A review.

Indium. C. REID (Chem. and Ind., 1939, 837—838).—A review.
A. J. E. W.

Iodine and fluorine derivatives of monosilane. A. G. MADDOCK, C. REID, and H. J. EMELÉUS (Nature, 1939, **144**, 328).—In presence of AlI_3 at 80°, SiH_4 and HI yield SiI_4, $SiHI_3$, SiH_3I, b.p. 45·8°, m.p. −56·5°, and SiH_2I_2, a heavy liquid (v.p. 2—3 mm. at 0°). With Hg, SiH_3I gives SiH_4, and Si_2H_6, H_2, and HgI; both burn readily in air, forming SiO_2 and I. SiH_3I vapour absorbs light of λ < ~2800 A., and is rapidly decomposed by light in presence of O_2 with liberation of I. In presence of anhyd. Et_2O, SiH_3I reacts with Mg, some of which is dissolved. The residue is blackened, and a white, Et_2O-sol. compound separates in small amounts, whilst H_2 and SiH_4 are evolved. At room temp. in presence of $SbCl_5$, SiH_2Cl_2 and SbF_3 yield SiF_4 and SiH_2F_2, b.p. −77·5°, m.p. −119·1°, an inflammable gas which has no action on Hg or glass. SiH_3Cl reacts with SbF_3 in a similar manner.
L. S. T.

Compounds of titanium sulphate. I, II. B. E. BOGUSLAVSKAJA (J. Gen. Chem. Russ., 1939, **9**, 1077—1083, 1084—1085).—I. Dissolution of TiO_2 in excess of 60—90% H_2SO_4 at 100—225° is followed by deposition of crystals of $TiOSO_4,0—2H_2O$.

II. K_2TiF_6 is heated with H_2SO_4 to evolution of SO_3, and the cooled residue is diluted, when $Ti(SO_4)_2,4H_2O$ ppts.
R. T.

New class of ammines. Complex thiostannates. G. SPACU and A. POP (Bul. Soc. Ştiinţe Cluj, 1939, **9**, 307—317).—By the action of excess of Na_2S solution on $SnCl_4$ and pptn. with EtOH the *compound* $Na_4SnS_4,10H_2O$ (I) is obtained. The grey-white crystals are stable in absence of acid vapours. Aq. solutions are stable in presence of excess of Na_2S, and the equilibrium $[SnS_4]'''' \rightleftharpoons [SnS_3]'' + S''$ is set up. By the action of ammines on solutions of (I) the following *compounds* have been prepared : $[Ni\ en_3][SnS_3]$; $[Co\ en_3]_4[SnS_4]_3,15H_2O$; $[Cr\ en_3]_4[SnS_4]_3,8H_2O$; $[Cr(NH_3)_3Cl][SnS_3]$; $[Cr(NH_3)_5Cl]_2[SnS_4]$; $[Cr(NH_3)_5SCN][SnS_3],H_2O$; $[Cr(NH_3)_5SCN]_2[SnS_4],2H_2O$.
O. J. W.

[Decomposition of] hydrazine. C. H. BAMFORD (Trans. Faraday Soc., 1939, **35**, 1239—1246).—N_2H_4 vapour explodes when sparked, giving NH_3, N_2, and H_2, the H_2 probably arising from thermal decomp. of some NH_3. The explosion has been studied with and without addition of NO and pressure limits have been determined. Study of the heterogeneous decomp. of N_2H_4 vapour at a uniformly heated quartz surface in presence of NO (cf. A., 1939, I, 326) indicates that the primary reaction is probably dissociation into $2NH_2$.
F. L. U.

Fluorination of phosphorus trichloride. H. S. BOOTH and A. R. BOZARTH (J. Amer. Chem. Soc., 1939, **61**, 2927—2934).—Details of the fluorination of PCl_3 to $PFCl_2$, of $PFCl_2$ to PF_2Cl, and of PF_2Cl to PF_3 by SbF_3 in presence of $SbCl_5$ as catalyst are discussed. PCl_3 can also be fluorinated stepwise in the vapour phase by solid heated CaF_2. The reaction between PCl_3 and PF_3 at high temp. has been investigated; $PFCl_2$ and PF_2Cl are formed but in an impure state owing to side reactions occurring with the glass tube and resulting formation of P, POF_3, and SiF_4, the last two being extremely difficult to remove from PF_2Cl by fractionation. *Monofluorodichlorophosphine*, $PFCl_2$, is a colourless gas, condensible to a colourless liquid and a white solid (twig-like crystals); it hydrolyses in moist air, does not fume, and is absorbed by aq. NaOH; m.p. −144·0°±0·2°; b.p. 13·85±0·05°; v.p. log p (mm.) = 7·439−1308/T. *Difluoromonochlorophosphine*, PF_2Cl, is a colourless gas, condensible to a clear liquid and a white solid; does not fume; hydrolyses in moist air < $PFCl_2$; is stable at −78° (as a liquid); is absorbed by aq. NaOH; m.p. −164·8±0·2°; b.p. −47·3±0·05°; v.p. log p (mm.) = 7·043 − 939·7/T. PF_3 has m.p. −151·5±0·2°, b.p. −101·15±0·05°, v.p., log p (mm.) = 7·310 − 761·4/T. PF_3 hydrolyses very slowly in air, is odourless and toxic, causing, even in small concn., sharp chest pains. The crit. temp. and pressures of the fluorides are given. The reactions between the fluorides and Cl_2 have been studied. PF_2 and Cl_2 react rapidly under the influence of the

C arc to give PF_3Cl_2 (b.p. ~0·10°). $PFCl_2$ and PF_2Cl on chlorination yield unstable liquids, probably $PFCl_4$ and PF_2Cl_3. $PFCl_4$ decomposes in ~30 hr. at 25° to give a white solid (? PCl_5) and a colourless gas (? PF_5). PF_2Cl_3 decomposes much more slowly.
W. R. A.

Fluorination of phosphoryl trichloride. H. S. BOOTH and F. B. DUTTON (J. Amer. Chem. Soc., 1939, **61**, 2937—2940).—Fluorination of $POCl_3$ by SbF_3 and by CaF_2 yields POF_3 (b.p. −39·8±0·1°), *phosphoryl difluoromonochloride,* POF_2Cl (b.p. 3·1±0·1°; m.p. −96·4°), and *phosphoryl monofluorodichloride,* $POFCl_2$ (b.p. 52·9±0·1°; m.p. −80·1°). V.p. and crit. consts. of the products are given. The properties of the new compounds are intermediate between those of $POCl_3$ and POF_3; the compounds hydrolyse readily in air.
W. R. A.

Fluorination of phosphorus tribromide. H. S. BOOTH and S. G. FRARY (J. Amer. Chem. Soc., 1939, **61**, 2934—2937).—Controlled fluorination of PBr_3 has been carried out by SbF_3 at 70° and 170° (Br as catalyst) and in the vapour state by heated CaF_2. The products are PF_3, *monofluorodibromophosphine,* $PFBr_2$, m.p. −115°, b.p. 78·4±0·1°, v.p. log p (mm.) = 7·866 − 1646·2/T, and *difluoromonobromophosphine,* PF_2Br, m.p. −133·8°, b.p. −16·1±0·1°, v.p. log p (mm.) = 7·620 − 1217·9/T. Both give clear liquids and white cryst. solids, fume in air, have a pungent odour, react with Br to yield $PFBr_4$ and PF_2Br_3, and decompose to PF_3 and PBr_3. Both react with Hg to give Hg halides and P.
W. R. A.

Polymerisation and depolymerisation of phosphonitrile chlorides. O. SCHMITZ-DUMONT (Z. Elektrochem., 1939, **45**, 651).—$(PNCl_2)_3$ undergoes a homogeneous exothermic polymerisation reaction in a sealed tube (vol. 100 c.c. per g.) at 600°, with formation of $(PNCl_2)_4$ and liquid and cryst. higher polymerides, but no $PNCl_2$-rubber (I). Similar products are obtained from $(PNCl_2)_4$ or (I) under these conditions, showing that a true equilibrium exists between the various polymerides. The proportion of higher polymerides in the equilibrium mixture increases with the concn., and above a crit. val. (I) appears in the products. Depolymerisation of (I) is effected by heating at ≯380° in a vac. A. J. E. W.

Mechanism of hydrolysis of inorganic esters. J. B. M. HERBERT and E. BLUMENTHAL (Nature, 1939, **144**, 248).—Hydrolysis at 80—90° of Me_3PO_4 (I) with NaOH prepared from Na and H_2O enriched in ^{18}O, and ρ determinations of the H_2O formed after combustion of the MeOH produced by the hydrolysis, show that rupture occurs at the P–O linking of (I). ρ measurements of the residual H_2O show that, apart from the hydrolytic replacement of O, there is only a slight exchange of O between the H_2O and (I).
L. S. T.

Reactions of oxygen atoms. P. W. SCHENK and H. JABLONOWSKI (Z. Elektrochem., 1939, **45**, 650).—The following reactions occur at liquid air temp. in O_2 containing O atoms : $H_2S + O + O_2 = H_2SO_3$ (subsequently oxidised to H_2SO_4; no S separates if H_2S : O is ≯1); $2NO_2 + O = N_2O_3$. Cl_2 gives Cl oxides, including Cl_2O and ClO_2; Br gives BrO_2, but no higher oxide. A. J. E. W.

Non-interchange of elementary radiosulphur with carbon disulphide. R. A. COOLEY, D. M. YOST, and E. MCMILLAN (J. Amer. Chem. Soc., 1939, **61**, 2970—2971).—Since CS_2 is used extensively as a solvent for Ra-S in chemical and biological investigations it has been necessary to establish that no interchange occurs. Ra-S was prepared by ⁷₁D bombardment of a metal sulphide (I), followed by dissolving (I) in HCl and passing the H_2S into n-KI saturated with I. The KI solution was warmed and I volatilised while Ra-S coagulated to globules, principally of amorphous (μ-)S, insol. in CS_2. These globules could be converted into sol. S by heating in an autoclave. The exchange experiments were carried out by heating at 100° 3 mg. of Ra-S in 300 mg. of CS_2 in one leg of a sealed U-tube for from 42 to 68 hr., after which half of the CS_2 was distilled into the other leg of the U-tube. The contents of both legs were subjected to a Carius combustion and the H_2SO_4 formed was converted into dry Li_2SO_4, the activity of which was determined. The amount of interchange is <2%, *i.e.,* < the experimental error of activity determination.
W. R. A.

Preparation of alkali uranates, niobates, and vanadates in the dry way. H. GUITER (Compt. rend., 1939, **209**, 561—562).—The following coloured salts are prepared by heating the alkali carbonate with U_3O_8, Nb_2O_5, or V_2O_5 : M_2UO_4 (M = Na, K, Li, Rb, Cs; insol. in H_2O), $5M_2O,Nb_2O_5$ (Li, Na, K), $4M_2O,Nb_2O_5$ (Rb, Cs), $3M_2O,V_2O_5$ (Li, Na), $2M_2O,V_2O_5$ (K, Rb, Cs). The sulphates and V_2O_5 yield the following : $4Li_2O,5V_2O_5$, $2M_2O,3V_2O_5$ (Na, K), $M_2O,2V_2O_5$ (Rb, Cs). A. J. E. W.

Preparation of sources of Po–Be neutrons. C. HAENNY and M. HAÏSSINSKY (J. Chim. phys., 1939, **36**, 218—220).—A method involving reduction of a Po solution in a Be tube is described. The source of neutrons thus obtained has double the intensity of one made by deposition on Ag. F. L. U.

Action of hydrogen sulphide on paraperiodic acid. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 339—342).—When saturated aq. H_2S solution is added to 1% aq. paraperiodic acid (H_5IO_6) free I and colloidal S are immediately formed. The colour becomes progressively deeper but after a time fades. This is due to the reduction of H_5IO_6 occurring in two stages : (a) $6H_5IO_6 + 15H_2S = 3I_2 + 2H_2SO_4 + 13S + 28H_2O$; (b) $3I_2 + 3H_2S = 6HI + 3S$. Reaction (b) does not commence until (a) is completed. W. R. A.

Action of strong solutions of alkalis on potassium ferricyanide. E. BARNES (J. Indian Chem. Soc., 1939, **16**, 308—309).—With sufficiently conc. KOH free O_2 is obtained from $K_3Fe(CN)_6$ thus : $4K_3Fe(CN)_6 + 4KOH = 4K_4Fe(CN)_6 + 2H_2O + O_2$. The vol. of O_2 is < the theoretical amount and some N_2 is present, suggesting that some (CN) groups have been oxidised. However, since no $Fe(OH)_3$ is formed it would seem that no $[Fe(CN)_6]'''$ radicals are completely broken up. W. R. A.

New complex ammines belonging to the group of iron and cobalt dinitrosothiosulphates. G. SPACU and C. G. MACAROVICI (Bul. Soc. Ştiinţe Cluj,

1939, **9**, 197—206).—By addition of various ammines to an aq. solution of $Na[(NO_2)_2FeS_2O_3],2H_2O$ at $0°$ the following *compounds* have been prepared : *trans*-[Co en$_2$Cl$_2$]A (yellowish-green), [Cu en$_3$]A_2,2H$_2$O (bronze), [Co(NH$_3$)$_6$]A_3,4H$_2$O (brown), [Co en$_3$]A_3,4H$_2$O (brown), and [Cr en$_3$]A_3,4H$_2$O (yellowish-brown), where $A = [(NO_2)_2FeS_2O_3]'$. The anion A is fairly stable in solution at $0°$. By mixing aq. solutions of $K_3[Co(NO_2)_2(S_2O_3)_2]$ and of various ammines and pptg. with EtOH the following *compounds* were obtained : *cis*-[Co en$_2$Cl$_2$]$_3B$,2H$_2$O (violet-brown), [Co en$_3$]B,H$_2$O (brown), [Co(NH$_3$)$_6$]B,3H$_2$O (bronze), [Cr en$_3$]B,3H$_2$O (bronze), [Co(Co(OH)$_2$en$_2$)$_3$]B_2,3H$_2$O (brown), where $B = [Co(NO_2)_2(S_2O_3)_2]'''$. Both the A and B compounds decompose slowly with evolution of NO on keeping, but are stable at low temp. O. J. W.

Co-ordination power of phenylethylenediamines. I. Para- and dia-magnetic tetramminonickel salts. I. LIFSCHITZ, J. G. BOS, and K. M. DIJKEMA (Z. anorg. Chem., 1939, **242**, 97—116). —By the action of (CH$_2$·NHPh)$_2$ (" stien ") and of NH$_2$·[CH$_2$]$_2$·NHPh (" phenen ") on salts of bivalent metals (Cu, Co, Ni, Pt, Zn, Hg) brightly coloured complex salts of the types [M stien$_2$]X$_2$ and [M phenen$_2$]X$_2$ are obtained (X = one equiv. of an anion). The prep. of 31 such compounds is described. The Ni compounds occur in blue and yellow forms which are without exception paramagnetic and diamagnetic, respectively. The magnetic and other evidence shows that the blue and yellow compounds are isomerides, in which Ni has a co-ordination no. 4. In the yellow compounds the complex contains two non-polar Ni–N linkages. O. J. W.

Complex nickel salts with quadri- and sexavalent central atom.—See A., 1939, II, 471.

Recent developments of spectrographic analysis. E. VAN SOMEREN (Metallurgist, 1939—40, **12**, 29—31, 44—46).—A review. C. E. H.

Hydroxy- and amino-azonitro-compounds. II. α-Naphtholazo-p-nitrobenzene as an indicator for hydrogen ions in non-aqueous solutions. L. KULBERG (J. Gen. Chem. Russ., 1939, **9**, 684—692 ; cf. A., 1939, II, 257).—The micro-titration of acids and alkalis in aq. solutions of MeOH, EtOH, and COMe$_2$ may be carried out by using α-naphtholazo-p-nitrobenzene as an indicator under standard conditions. The neutral salt error is very small. The theory of the method is discussed. V. A. P.

Polarographic method in organic chemistry. I. Electroreduction of peroxides. A. A. DOBRINSKAJA and M. B. NEUMANN (Acta Physicochim. U.R.S.S., 1939, **10**, 297—306).—The polarographic method has been applied to the determination of H_2O_2, MeO_2H, and $(EtO)_2$. The method is capable of detecting 2.5×10^{-7} g. of H_2O_2, 10^{-7}—10^{-8} g. of MeO_2H, and 10^{-7} g. of $(EtO)_2$ per ml. and is particularly applicable to the determination of peroxides in composite condensates obtained during the cool-flame oxidation of hydrocarbons. C. R. H.

Bromoiodometric investigations. XI. Is the Hahn fluorescein reaction specific for bromine? J. H. VAN DER MEULEN (Chem. Weekblad, 1939, **36**,

702—705).—The formation of a red coloration when fluorescein solution is treated with chloramine-T is not sp. for Br ; it is also produced even more rapidly in daylight by I. Br can be detected in presence of I by buffering the solutions with either H_3BO_3 (31 g.) and N-NaOH (8 c.c. per l.) or 0.1N-NaH_2PO_4, in which only I is liberated. S. C.

Determination of iodine in *Fucus vesiculosus*. —See B., 1939, 1175.

Determination of sulphate in waters by the volumetric chromate method. J. COURTOIS and P. BONJEAN (Ann. Chim. Analyt., 1939, [iii], **21**, 229—235).—The method given in " Einheitsverfahren der physikalischen und chemischen Wasseruntersuchung " (Berlin, 1936) leads to low results, mainly owing to adsorption of CrO_4'' on the pptd. BaSO$_4$ and BaCrO$_4$. A crit. investigation of each stage of the method shows that (i) the error due to adsorption is much reduced by pptn. at $100°$, (ii) the use of higher [KI] and dil. H_2SO_4 gives a more accurate iodometric determination of CrO_4'' in the filtrate, and (iii) other stages of the process are less crit. H_3PO_4 and $HClO_4$ cannot be used instead of HCl or H_2SO_4 to liberate I from the CrO_4'' and I'. With 37—150 mg. of SO_4'', the modified method detailed reduces the error in the determination from 11 to 3.5%. L. S. T.

Argentometric titration of selenious acid. R. RIPAN-TILICI (Z. anal. Chem., 1939, **117**, 326—330). —The solution containing SeO_3'' (~0.01M.) is neutralised with NaOH to p_H 9.6 (thymolphthalein) and titrated with 0.05—0.1N-AgNO$_3$ in presence of 2—3 drops of 0.2% alcoholic fluorescein (I). The Ag$_2$SeO$_3$ first pptd. weakly adsorbs (I) and is coloured yellowish-red, but at the equivalence point the colour changes to bright red owing to marked adsorption of (I) by (Ag$_2$SeO$_3$)Ag$^{\cdot}$. 0.5 c.c. of 0.2% diphenylcarbazone can replace (I). The ppt. is then first coloured violet, and near the equivalence point the colour changes to blue. This colour fades on shaking. More indicator (0.3 c.c.) is added, and at the equivalence point the ppt. is coloured blue suddenly and the solution is colourless. Both methods give results in agreement with those obtained potentiometrically (A., 1939, I, 486). L. S. T.

Beer's law and Lambert's law in the photometric examination of coloured solutions. C. TOFFOLI (R. Ist. San. Pubbl., 1939, **2**, 575—586).— Deviations from the Beer–Lambert law occurring in the examination of dil. aq. NH$_3$, treated with Nessler's reagent, by the step-photometer are discussed. F. O. H.

Determining residual ammonia in presence of chloroamine [in water].—See B., 1939, 1185.

Determination of nitrogen in leather.—See B., 1939, 1155.

Colorimetric micro-determination of nitrates. M. PESEZ (J. Pharm. Chim., 1939, [viii], **30**, 112— 117).—The reaction described previously (A., 1939, I, 384) is used for the determination of NO_3'. The colour intensity $\propto$ concn. for 0.1—1 mg. of NO_3'. Cl', but not NO_2', interferes with the reaction, and must be removed by addition of the equiv. amount of Ag$_2$SO$_4$. Details of procedure for the determination

of NO_3' in pure solutions and in potable waters are given.   L. S. T.

Indirect volumetric determination of arsenates. G. SPACU and M. VANCEA (Bul. Soc. Ştiinţe Cluj, 1939, **9**, 318—320).—The AsO_4''' is pptd. with $AgNO_3$ solution in presence of NH_4NO_3 and NH_4OAe, and after filtration the excess of Ag is determined by Volhard's method. The method is rapid and accurate.   O. J. W.

Detection and determination of arsenical war gases in drinking water.—See B., 1939, 1184.

Determination and occurrence of boron in natural phosphates, superphosphates, and de-fluorinated phosphate rocks.—See B., 1939, 1113.

Determination of small amounts of boron [in soils and plants].—See B., 1939, 1159.

Volumetric determination of alkali sulphate. A. KRÜGER (Z. anal. Chem., 1939, **117**, 333).—Aq. Na_2SO_4 containing $BaCO_3$ in suspension is completely transformed into Na_2CO_3 by the passage of CO_2. The filtrate from the $BaCO_3$ and $BaSO_4$ is titrated with N-HCl (Me-orange).   L. S. T.

Electrometric determination of the tarnish products on silver and copper alloys.—See B., 1939, 1132.

Determination of magnesium and manganese in fertilisers.—See B., 1939, 1160.

Derivatives of 8-hydroxyquinoline in analytical chemistry. J. MOLLAND (Tids. Kjemi, 1939, **19**, 119—122).—Salts of 7-nitro-8-hydroxyquinoline-5-sulphonic acid have been studied. The insol. *Pb* salt is suitable for gravimetric determinations. The characteristic microcryst. *Na, K, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Al, Tl, Co, Ni, Cu*, and *brucine* salts may be used for microscopic identification.   M. H. M. A.

Drop analysis. O. S. FEDOROVA (Trans. Ivanovo Chem. Tech. Inst., 1939, 40—42).—The drop reaction for Pb using a mixture of $KSnI_3$ and $Cd(NO_3)_2$ is improved by substituting $H_2C_2O_4$ for $Cd(NO_3)_2$. A modification of the Mo-blue test for detecting Sb in presence of Sn is described.   R. C.

Iodometric determination of copper in nitric acid solution. W. ORLIK (Z. anal. Chem., 1939, **117**, 332—333).—Attention is directed to the author's prior communication (A., 1930, 444), which has been overlooked by Hagen (A., 1939, I, 430).   L. S. T.

Separation of copper from cadmium. E. CRESPOLANI (Boll. Chim. farm., 1939, **78**, 459).—The use of warm dil. H_2SO_4, which dissolves CdS but not CuS, is advocated for the separation of Cu from Cd in qual. and toxicological analysis.   O. J. W.

2 : 2'-Diquinolyl ; a reagent for copper. J. G. BRECKENRIDGE, R. W. J. LEWIS, and L. A. QUICK (Canad. J. Res., 1939, **17**, B, 258—265).—2 : 2'-Di-quinolyl (I), prepared by catalytic dehydrogenation of quinoline, gives a purple colour with $Cu^.$ which is sp. and has sensitivity 1 in 10^8. The intensity of the colour produced follows Beer's law and a calibration curve obtained using a photo-electric colorimeter is given. Ni and Fe interfere in determinations of $Cu^.$ by the reagent and are first removed with dimethyl-

glyoxime and aq. NH_3 respectively. To the Cu sample containing 4×10^{-5} g. per ml., 5 ml. of 10% $NaHSO_3$ solution, 1 ml. of solution of (I) in glacial AcOH (0·5 g. per l.), and sufficient glacial AcOH to produce 50 ml. are added, the intensity of colour being measured in a photo-electric colorimeter. Stable complexes of (I) with $CuCl_2$ and $CoCl_2$ are described.   F. H.

Determination of small amounts of copper in [agricultural] spray residues.—See B., 1939, 1163.

Analysis of German-silver alloys.—See B., 1939, 1128.

Reactions of rare earths and allied elements with polyhydric phenols and alkaloids. VII. Colorimetric determination of cerium with brucine, and the reaction between persulphate and brucine. F. M. SCHEMJAKIN and V. A. VOL-KOVA (J. Gen. Chem. Russ., 1939, **9**, 698—700).—Optimum conditions for the colorimetric determin-ation of Ce with brucine (A., 1938, I, 535) have been determined. A new colour reaction between $(NH_4)_2S_2O_8$ and brucine, which may be used for the detection of either reactant, is described. V. A. P.

Separation of iron, aluminium, and chromium from cobalt, nickel, and manganese by means of pyridine. C. G. MACAROVICI (Bul. Soc. Ştiinţe Cluj, 1939, **9**, 207—214).—The separation of Al and Cr from mixtures with Co, Ni, and Mn by Ostroumov's method (cf. A., 1936, 1222) is unsatisfactory.   O. J. W.

α-Nitro-β-naphthol as precipitant for cobalt and palladium. C. MAYR and W. PRODINGER (Z. anal. Chem., 1939, **117**, 334; cf. A., 1934, 1324).— $1 : 2\text{-}NO_2 \cdot C_{10}H_6 \cdot OH$ (I) prepared by the method of Stenhouse and Groves (Annalen, 1877, **189**, 151) contains considerable amounts of nitrosonaphthol. Pure (I), obtained by the method of Liebermann and Jacobson (A., 1882, 521), gives no ppt. with Co or Pd.   L. S. T.

Colorimetric determination of chromium as trioxalatochromic acid.—See B., 1939, 1154.

Determination of tungsten. N. N. KOROBOV (Trans. Ivanovo Chem. Tech. Inst., 1939, 33—36).—The WO_4'' solution, containing 5 drops of a 0·1% solution of diamine-fast-scarlet 6BS, is titrated at the b.p. with 0·1N-$Pb(NO_3)_2$. At the end-point the dye is withdrawn from the solution by the ppt. NH_4NO_3, HCl, AcOH, and HNO_3 interfere.   R. C.

Oxidation–reduction indicators. II. Fuchsin and new-fuchsin as indicators in titration of tin and antimony with bromate. Z. G. REICHINSTEIN (Trans. Ivanovo Chem. Tech. Inst., 1939, 36—40).—$SnCl_2$ and $SbCl_3$ can be titrated at room temp. with $NaBrO_3$ using the above as (reversible) indicators. At the end-point the yellow or violet solution becomes orange. Too small a [HCl] causes error.   R. C.

Volumetric determination of titanium in its ores and in ferrotitanium.—See B., 1939, 1113.

Spectrophotometry of reflecting materials. R. DONALDSON (J. Sci. Instr., 1939, **16**, 114—117).—The specimen is illuminated normally and all light diffused from it between the angles 35° and 55° is focussed onto a photo-cell by means of two spherical

concave mirrors. The conditions of the Commission Internationale de l'Eclairage (C.I.E.) are thus adhered to. The sensitivity of the instrument does not fall below 0·3 of its val. when measuring transparent materials.   F. J. L.

Vacuum grating spectrograph mounting. W. R. S. GARTON (J. Sci. Instr., 1939, **16**, 117—121).— The grating is mounted on the Eagle plan inside a chamber which can be evacuated. A lock between the chamber and the main tube minimises the time necessary for pumping and adjustments, which can all be made from without the evacuated chamber. The apparatus is sensitive in the extreme ultra-violet.   F. J. L.

Permanent nephelometer from Pyrex glass.— See A., 1939, III, 1113.

Method of designating colours. D. B. JUDD and K. L. KELLY (J. Res. Nat. Bur. Stand., 1939, **23**, 355—385).—A system of describing the colours of powders is developed. Suggestions are made for its extension to opaque non-metallic surfaces generally and to transparent and translucent materials.   J. W. S.

[Analytical] applications of the Rayleigh inter-ferometer.—See B., 1939, 1080.

Application of the filter method in objective heterochromatic photometry. H. KÖNIG (Helv. Phys. Acta, 1939, **12**, 313—329).—The photometric comparison of monochromatic with incandescent electric light in the middle region of the visible spectrum by means of filtered and unfiltered Se cells, and by means of the thermopile with combination filters, has been studied. By the former method, the accuracy attainable is 2%, as compared with 1% by the latter.   L. J. J.

Effect of tube-length on the visibility of dust particles with an oil-immersion objective. (A) D. G. BEADLE and H. S. PATTERSON. (B) F. E. J. OCKENDEN (Nature, 1939, **144**, 327, 516).—(A) In certain circumstances a considerable fraction of the finest dust particles examined are not visible until the tube-length is reduced by ~2—3 cm.

(B) The effect is well known. The change in tube-length given above has no scientific significance.   L. S. T.

Focussing device for micrography. R. L. DOWDELL and C. H. GREEN (Met. Progr., 1939, **36**, 40—41).—A ground glass hangs freely in the plane of focus and carries a magnifier for focussing sharp images.   R. B. C.

Cells without transference for p_H determination. O. REDLICH and H. KLINGER (J. Amer. Chem. Soc., 1939, **61**, 2983).—To eliminate the source of experimental and theoretical inconvenience in routine p_H determination using cells with liquid junctions, cells of the type H_2, $H^+X' + TlBr$ (sat.), AgBr, Ag have been examined (cf. Hamer, A., 1937, I, 581). The solubility of TlBr is high enough to secure a definite potential uninfluenced by common impurities, and is yet so low that the activity of the $H^{\cdot}$ ion is not appreciably altered, and the liquid junction potential between a solution containing no TlBr and a solution saturated with TlBr may be

safely neglected. This liquid junction can further be avoided by saturating with TlBr that part of the solution in contact with the H_2 electrode. This type of cell is applicable only to solutions which do not form any ppt. when saturated with TlBr, and do not contain $Tl^{\cdot}$ or Br' ions in an amount comparable with the solubility of this salt. The use of similar electrodes as reference electrodes under these conditions is indicated.   W. R. A.

The diode as a frequency-changer for measurements at ultra-high frequencies. G. F. GAINSBOROUGH (Nature, 1939, **144**, 548—549).   L. S. T.

The new ultramicroscope. ANON. (Sprechsaal, 1939, **72**, 389—391).—The electron microscope is described.   G. H. C.

Electron ultramicroscope for research institutes. B. VON BORRIES and E. RUSKA (Naturwiss., 1939, **27**, 577—582).—The construction of an electron ultramicroscope and the technique of using it are described. Some uses of the instrument are briefly indicated.   A. J. M.

Production of very fine quartz fibres. A. H. S. HOLBOURN (J. Sci. Instr., 1939, **16**, 331—334).— An elastic-catapult method of producing long lengths of quartz fibre between 0·1 and 5 μ. in diameter is described. The fibre is produced with both ends attached to given points and stretched tightly between them.   D. F. R.

Simple valve for use in laboratory apparatus. G. P. GIBSON (J.S.C.I., 1939, **58**, 317—319).—A laboratory valve which is superior to a tap for controlling the rate of flow of hot fluids is described. It has been adapted for use in (i) an all-glass steam-vacuum still, (ii) a partial-reflux still-head, and (iii) the reservoir of a reaction vessel. The valve in (i) controls the amount of steam drawn by vac. through the liquid being distilled, in (ii) divides the stream of boiling liquid falling from a total condenser into two portions, one of which passes to the receiver and the other returns to the column as reflux, and in (iii) controls the rate of flow of a hot liquid from a reservoir to a reaction vessel. Rotation of the plug of the valve when in use in an apparatus under reduced pressure may be effected through a metal gland.

Methods and apparatus for micro-gas analysis. H. HARTRIDGE (J. Sci. Instr., 1939, **16**, 317—324).— A review of existing methods. Improvements for obtaining greater accuracy are suggested. The diver and mica-plate methods, recently devised for estimating the O_2–CO_2 exchange in living tissue, could be extended to gas analysis. An accuracy of ~0·01% on a vol. of only 20 cu. mm. should be obtained.   D. F. R.

Saturation of gases by laboratory wet test meters. F. A. SMITH and J. H. EISEMAN (J. Res. Nat. Bur. Stand., 1939, **23**, 345—353).—Tests on a laboratory wet test meter registering 0·1 cu. ft. per revolution indicate that the saturation of dry air is >98% complete at all practicable rates of flow. The error in vol. indicated owing to incomplete saturation is <0·2%, whilst the error due to failure to

level the meter is $<0.1\%$ if the quantity of H_2O present is the same as at calibration.   J. W. S.

Determination of solubilities of gases in liquids with use of the Van Slyke–Neill manometric apparatus for both saturation and analysis. D. D. VAN SLYKE (J. Biol. Chem., 1939, **130**, 545—554).—The technique is described (cf. A., 1924, ii, 872; 1927, 800). Solubilities in aq. solutions and in oils can be determined at room temp. and saturation as well as analysis are carried out in the chamber of the apparatus. Saturation is obtained by first shaking the liquid in the chamber with the gas at slightly above atm. pressure and then at exactly atm. pressure. The unabsorbed gas is ejected and then the amount of gas in the liquid is determined. Results const. to 1 part in several hundred can be obtained.   J. N. A.

High-speed oil-vapour condensation pumps. M. MATRICON (J. Phys. Radium, 1939, [vii], **10**, 385—388).—A method for measuring the pumping speeds of oil-diffusion pumps is described. The effect of the nature of the gas is discussed.
                    H. J. E.

Separation of gases by diffusion. C. G. MAIER (J. Chem. Physics, 1939, **7**, 854).—If the constituents of a binary mixture of gases (e.g., H_2 and N_2 or CO) are allowed to diffuse into a third condensible vapour (e.g., steam) the relative rates of diffusion generally approximate closely to the Graham's law ratio. The construction and performance of an apparatus are described.   W. R. A.

Construction and operation of a thermal diffusion column for the separation of isotopes. T. I. TAYLOR and G. GLOCKLER (J. Chem. Physics, 1939, **7**, 851—853).—The change in the abundance ratio of $^{13}CH_4$ by thermal diffusion has been studied in a column, the construction and operation of which are described.   W. R. A.

Enrichment of mercury isotope by a separation tube method. W. GROTH and P. HARTECK (Naturwiss., 1939, **27**, 584).—Apparatus for making use of the Clusius method to separate partly the isotopes of Hg is described. About 0·25 g. of " light " Hg was separated per hr., and the difference in d between it and ordinary Hg was detected by using it in a barometer tube. The method can be applied to vapours of other metals, e.g., Cd.   A. J. M.

Thermal method for the separation of gases and isotopes. A. BRAMLEY and A. K. BREWER (Science, 1939, **90**, 165—166).—In the concentric-tube method of separation (cf. A., 1939, I, 483), efficiency of design has been investigated for the separation of 1 : 1 mixtures of CH_4 and NH_3, and He and Br, and of the Cl isotopes in HCl. Optimum conditions depend on the nature of the gas, and separation depends primarily on the difference in mass of the two components divided by their sum. Conditions involving wall symmetry and corrugations enhance swirl definition and thereby increase separation.   L. S. T.

Crystallo-chemical analysis. The Barker index at Oxford. M. W. PORTER and R. C. SPILLER (Nature, 1939, **144**, 298—299).—The Barker method of identifying crystals from measurements of their angles is outlined, and examples of its use are described.   L. S. T.

Apparatus for detecting carbon monoxide in air.—See B., 1939, 1182.

Separation and fractionation [of proteins, enzymes, etc.] by froth flotation.—See A., 1939, III, 1020.

Splitting of mica (muscovite) for optical purposes. F. E. WRIGHT (Amer. J. Sci., 1939, **237**, 736—741).—A method for obtaining strips of mica suitable for use in optical instruments and of any phase angle, or thickness $>1.5\,\mu$, is described. An arrangement of the petrographic microscope for measuring the phase angle of a mica plate or foil by the Friedel method is given.   L. S. T.

Method of producing a long single-crystal wire of aluminium with any desired crystallographic axis. T. FUJIWARA (J. Sci. Hirosima Univ., 1939, **9**, 227—231).—By the method described a long single-crystal wire of Al can be obtained with any desired crystallographic axis oriented in the direction of the wire axis by submitting it to annealing only.   W. R. A.

Georg Lunge, 1839–1923. E. BERL (J. Chem. Educ., 1939, **16**, 453—460).   L. S. T.

Geochemistry

Temperature of the stratosphere in high latitudes. A. VASSY and E. VASSY (Nature, 1939, **144**, 284).—Computations of the mean temp. of atm. O_2, and radio-sounding measurements, indicate that in arctic regions the stratosphere is hot in summer and cold in winter, and that the higher is the altitude the greater is the difference between the extreme temp.   L. S. T.

Atmospheric ozone. II. E. VASSY (J. Phys. Radium, 1939, [vii], **10**, 366; cf. A., 1939, I, 391).—A reply to Barbier and Chalonge (ibid., 495).
                    W. R. A.

Helium–neon content of sea-water and its relation to the oxygen content. N. W. RAKE-STRAW, C. R. HERRICK, jun., and W. D. URRY (J. Amer. Chem. Soc., 1939, **61**, 2806—2807).—A repetition of earlier work (A., 1935, 724) under more suitable and representative conditions shows that the sea is approx. saturated with Ne and He at all depths, and there is no indication of a depth of min. concn. Hence there is no relation with the depth of min. $[O_2]$.   W. R. A.

Mineral springs of Boario (Brescia). G. BRA-GAGNOLO (Annali Chim. Appl., 1939, **29**, 402—413).—Data for chemical, physico-chemical, radioactive, bacteriological, and pharmacological properties are tabulated.   F. O. H.

Physico-chemistry of thermal water of Monfalcone. B. Doro (Annali Chim. Appl., 1939, **29**, 374—380).—Coeffs. of solvent and ionic activities are calc. from analytical data previously given (A., 1939, I, 392). F. O. H.

Fluoride in potable waters of Valsugana (Trentino). D. E. Dall'eco (Annali Chim. Appl., 1939, **29**, 340—344).—The method of micro-determination of F' used [distillation as H_2SiF_6 and titration with $0.01N$-$Th(NO_3)_4$] is described. Samples from 122 places in the district have [F'] 0.05—1.70 mg. per l. F. O. H.

Analysis of mineral waters of the Sangiorz-Bai springs [Roumania]. V. Alexa (Bul. Soc. Ştiinţe Cluj, 1939, **9**, 260—269).—Chemical composition and physico-chemical data for five H_2O sources, which are rich in NaCl, $Ca(HCO_3)_2$, and $Mg(HCO_3)_2$, and contain appreciable amounts of Mn and Fe and traces of Li, Br, I, B, and Rn, are recorded. O. J. W.

Chemical features of Yellowstone National Park. I. B. Douglass (J. Chem. Educ., 1939, **16**, 422—435).—Characteristics of the different types of springs and chemical phenomena associated with the phase of volcanism found in this locality are described and illustrated by photographs. Selected chemical analyses of the gases and springs are given. L. S. T.

Hot-spring problem. A. L. Day (Bull. Geol. Soc. Amer., 1939, **50**, 317—336).—An address in which the origin, meteoric or magmatic, of hot-spring waters, particularly of Yellowstone Park, is discussed. Recent work on these springs is summarised. L. S. T.

Vanadium, chromium, and molybdenum contents of the hot springs of Japan. K. Kuroda (Bull. Chem. Soc. Japan, 1939, **14**, 307—310).—Data are recorded for nine springs, giving V 0—0.247, Cr 0—0.073, Mo 0.0004—0.016 p.p.m., respectively. A spectrographic method for determining Mo is described. L. J. J.

Analysis of the water and mud from the lake and environs of the "baths of the town of Turda" [Roumania]. C. G. Macarovici and E. Popper (Bul. Soc. Ştiinţe Cluj, 1939, **9**, 270—280).—Chemical composition and physico-chemical data are given. O. J. W.

Solubility of copper components in cupro-calcic muds. A. Quartaroli and A. Raitu (Annali Chim. Appl., 1939, **29**, 419—424).—Cu compounds in effluvial muds are only slightly sol. in alkaline media; they are sol. initially in acid or neutral media but gradually become less sol. until they are merely in suspension. The results are discussed with reference to the winning of Cu from effluvial muds. F. O. H.

Exchangeable manganese in river and ocean muds. K. J. Murata (Amer. J. Sci., 1939, **237**, 725—735).—Chemical examination of muds from the Colorado, Mississippi, Ohio, Potomac, and Monocacy rivers, of red deep-sea clay, of terrigenous blue mud, and of the delta deposit of the Mississippi river, and of a Pacific red clay shows that Mn in an exchangeable form exists in river and ocean muds. This Mn co-exists with dissolved Mn in the waters in direct contact with the muds. The amount of exchangeable Mn decreases as the total Mn in the muds increases. High total Mn in sediments is due to accumulation of insol. MnO_2,nH_2O minerals of unknown composition. Reducing conditions arising from the decomp. of org. matter increase exchangeable Mn and decrease the insol. Mn oxides in the sediments. The oxidising conditions that usually prevail in absence of decomp. org. matter favour the reverse process. Mn contents of the muds etc. and the solubilities of rhodochrosite, wad, etc. in N-NH_4OAc are recorded. L. S. T.

Definition of the ooze of estuaries. J. Bourcart (Compt. rend., 1939, **209**, 542—544).—The viscous grey or black ooze found in Atlantic estuaries consists of inorg. material ($\not> 70\%$), including a sandy constituent, bound together by org. matter containing a trace of Fe, which results from the decomp. of algæ and vegetation. A. J. E. W.

Mean chemical composition of meteoritic accretion. F. G. Watson, jun. (J. Geol., 1939, **47**, 426—430).—The ratio of falling stony to metallic materials probably lies between 1 : 1 and 4 : 1. The average chemical composition of all meteorites computed for this range of ratios is tabulated. L. S. T.

Properties of white sapphire. S. Freed, H. L. McMurry, and E. J. Rosenbaum (J. Chem. Physics, 1939, **7**, 853).—Plane transparent windows of white sapphire, cut from synthetic crystals of corundum (pure Al_2O_3), show excellent transmission throughout the visible and in the ultra-violet to ~1435 A. The high chemical stability of cryst. Al_2O_3 suggests that it might withstand corrosive liquids and gases, and this has been confirmed by the observation that white sapphire windows have remained unattacked after contact with liquid and gaseous HF for 15 hr. W. R. A.

Fluorescence of Finnish minerals in ultra-violet light. L. H. Borgström (Bull. Comm. géol. Finlande, 1936, **9**, 349—355; Chem. Zentr., 1937, i, 3113).—The colour and approx. intensity of fluorescence in a no. of minerals are recorded. A. J. E. W.

Petrography of the crystalline limestones and quartzites of the Grenville series [of Ontario]. E. C. Bruce and G. A. Russell (Bull. Geol. Soc. Amer., 1939, **50**, 515—528).—The Grenville rocks are mainly of sedimentary origin. They were originally an interbedded series of sands, clays, and limestones which are now quartzites, gneisses, and cryst. limestones. Some of the latter are dolomitic, and most of them contain small amounts of non-carbonate minerals. SiO_2 was added by intrusives, resulting in the formation of non-aluminous silicates of Mg and Ca from the original $CaCO_3$ and $MgCO_3$. Minor silicates throughout the cryst. limestone were formed by reactions between gaseous emanations from the granite or pegmatite and the original carbonates. Quartzites (mineral analyses given) are interbedded with the limestones and, owing to the less reactive nature of quartz, are much less contaminated by foreign minerals than is the limestone. L. S. T.